

SONORAN QUARTERLY

FOR MEMBERS AND FRIENDS OF THE DESERT BOTANICAL GARDEN

PHOENIX, ARIZONA MARCH 2010, VOLUME 64, NO. 1



LOCALLY GROWN, INTERNATIONALLY KNOWN



“If you visit Phoenix, there are two places you must go: the Desert Botanical Garden and the Heard Museum.” How often do we hear that? I hear it all the time, and with good reason. The Garden and the Heard Museum offer authentic Southwestern experiences that just cannot be found anywhere else.

With increasing frequency, in addition to our recognition as a local point of pride, the Garden is also playing a role in national and international arenas. Readers will find three articles in the following pages that bring this point home:

Cathy Babcock, director of horticulture, writes of her recent journey to Oman. She and two colleagues from Australia and South Africa were invited to advise the Omanis in best practices as they design and build a new botanical garden showcasing the flora of their country.

Dr. Andrew Salywon, assistant herbarium curator, describes the Garden's leadership in the global effort to make herbarium vouchers fully accessible on-line. Using funds received from an NSF grant, he and a team of distinguished Arizona botanists are currently digitizing and data-basing our herbarium collections so that they can be accessed by anyone on the World Wide Web.

Elaine McGinn, director of exhibits and planning, has received a fellowship from the Virginia G. Piper Trust to travel to Italy and Spain to study the history of garden design. In this case, the Garden will be the



recipient of the global flow of knowledge, and Elaine will use what she learns in Europe to design new and better exhibits for our own Garden.

I am sure that you share my pride in all that these staff members have accomplished on behalf of the Garden and its mission of conservation, education, research, and exhibition. We exist first and foremost to serve our local community and will always keep that responsibility at the heart of everything we do. But it is also satisfying to know that what we do is making a difference in communities around the world.

Ken Schutz,
The Dr. William Huizingh Executive Director

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In Appreciation

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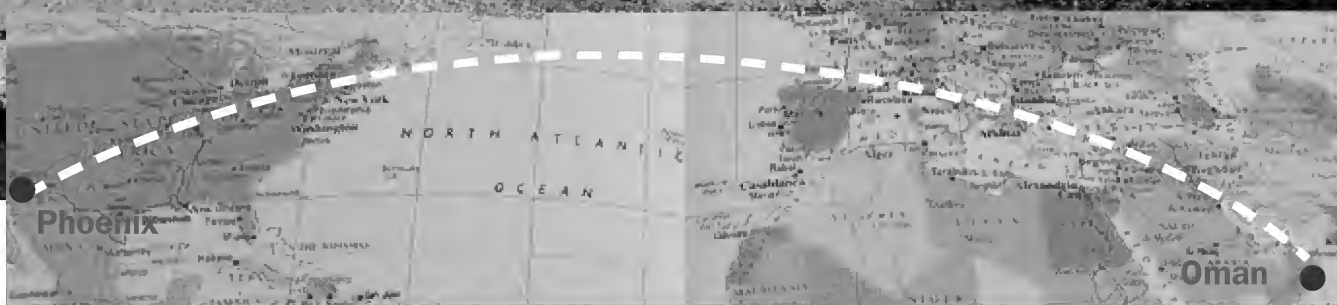
View of *Aloe marlothii*, mountain
aloe, *Yucca valida* and *Y. treculeana*
from inside the Sybil B. Harrington
Succulent Gallery. Photo by Adam
Rodriguez, adamsphoto@cox.net

Back Cover

Spring Plant Sale -
Members' Preview, March 19



Desert Botanical Garden assists the **NEW OMANI GARDEN**



Last August, the Desert Botanical Garden received a unique invitation from the Sultanate of Oman. We were invited to take part in an arid land workshop that would assist in developing strategies for a new botanic garden. Despite the long international flight—22 hours of flying time—it was a wonderful experience that resulted in a valuable exchange of information about every aspect of botanical garden management. The workshop was scheduled for only four days, lasting from November 15 -18, 2009.

Early Work

Sultan Qaboos bin Said first conceived the idea of the Oman Botanic Garden (OBG) in 2003. He envisioned a botanic garden that would feature both the flora and culture of Oman. Andrew Spalton, Advisor for Conservation of the Environment, Diwan of Royal Court, was tasked to research the concept. Following a discussion with Botanic Gardens Conservation International (BGCI) in London, he and an Omani staff member of Diwan of Royal

Court visited Alice Springs Desert Park in Australia. From that visit they determined that the OBG should feature the flora of Oman as a series of natural habitats. With continued assistance from BGCI, they compiled a feasibility study and then commissioned a master plan, a design concept, and a branding study.

Mark Richardson, a botanical consultant from Australia and formerly with BGCI, was then asked to arrange an arid zone workshop, which brought Desert Botanical Garden into the picture. The other two participants were Alice Springs Desert Park in the Northern Territory, Australia, represented by Gary Dinham, past senior horticulturist and now assistant curator of botany; and Karoo Desert National Botanical Garden in South Africa, represented by Ian Oliver, curator. Together, we represented three noted arid zone gardens from three different continents in a cooperative effort to assist the Oman Botanic Garden in addressing important establishment and management issues. The Oman Botanic Garden team consisted of ten

by Cathy Babock, Director of Horticulture

staff members, including both Omanis and expatriate experts.

The expected outcome of the workshop is a set of draft guidelines addressing each of the issues discussed. The hope is that this will be the first in a series of meetings between participating arid zone botanic gardens.

The Projected Design

The garden itself is a very ambitious project. When completed, it will be the largest botanical garden on the Arabian Peninsula, encompassing 1,038 acres with an intensely developed area of about 150 acres. It will include the seven vegetation habitats found in Oman, with forty sub-habitats within the seven. The habitats are the Northern Gravel Desert, a wet *Wadi* (wash), Sand Desert, *Sabkha* or Salt Desert, Central Desert, Northern Mountains, and Southern Mountains. There will also be an agricultural display that will include date palms.

Two of the habitats will be recreated in three indoor biomes or conservatories. One biome will display the flora of the Southern Mountains. It will be divided into three separate areas displaying each of the seasonal conditions: fog season, the 'green' season between fog and dry season, and the dry season. These seasons will be cycled so that in twelve months each area of the biome will experience all three seasons and the visitor can see all three seasons at any one time of the year. It is not known how the plants will react to having the seasons out of norm. The hope is that the opportunistic nature of many desert plants will allow them to tolerate the out-of-season conditions. The second and third biomes will display the Northern Mountains. One will feature the higher-altitude agricultural terrace vegetation; the other will display the olive-juniper woodland vegetation.

Each of the seven habitats will have its own orientation center and will be accessible to visitors either by tram or on foot. Other than the orientation centers, there will be no artificial shade in any of the habitats. There will also be a visitor's center at the garden's entrance, a cultural center featuring the country's ethnobotanical heritage, a world-class hotel, and two



We were enthralled with their propagation facility, it was simply amazing! We peppered the two staff members in charge of the area with questions but we were kept to a strict schedule and were told that if we wanted to spend more time with them we had to make an appointment. With that we were ushered out to keep to our allotted time.



The topography of the site is fabulous. There is a natural wash running through the site that will become one of the habitats.

mosques onsite. At completion of the project, they expect to employ 350 staff members, up from the current level of thirty.

Four Packed Days

After my arrival on the evening of November 14th, the workshop kicked off early the next morning with a tour of the propagation facilities. We were in awe to say the least. The entire propagation area encompasses approximately six acres. There are seven greenhouses, four polyethylene plastic and three glass, all about seventeen

feet in height. The glasshouses have panels that can open to let heat out and fresh air in. The greenhouses are quite sizable, about 10,764 square feet. Everything about the houses is automated, from the retractable shade cloth on the top, to the waterwalls (pads) and fans on the sides, to the sprinkler systems. The tables are on rollers, allowing much more usable square footage than stationary benches. The entire propagation area was designed to hold 300,000 plants, which is the total number of plants they plan to display in the garden, with



On the field trip we visited a wet wadi as an example of one of the habitats they plan to display, creating a wet wadi out of an existing dry wadi (wash).



Examples of historic agricultural terraces. After viewing the historic terraces, we headed out to see some modern terraces. When we were told the hike would be even steeper and longer, I was forced to stay back with a couple of others from the team. My legs were already reeling from the first hike of climbing steep steps and balancing on narrow aqueduct walls.

plants being continually backed up as they are planted out.

Following the propagation tour, members of each group—Alice Springs, DBG, Karoo, and then Oman—gave a PowerPoint presentation on his or her respective garden, which included basic statistics on size of gardens, collection numbers, number of staff, etc. The OBG team had hoped for pre-construction original site pictures but none of us really had much to offer. The DBG presentation showed a picture of creosote flats, as that was the closest I could come to original site photos. Then we all piled into vehicles for a visit to the site. Although the vegetation is very sparse to nonexistent this time of year, the topography is fabulous. There are hills, small valleys, and small mountains throughout, plus the area is surrounded by higher mountains. A natural wash (wadi) running through the property will actually become one of the habitats on display.

The next two days were scheduled for sessions on site preparation, fertilization, pruning, what to expect the first

year after planting, most durable signage materials for arid zones, etc. (Having been forearmed with the agenda, I had met several times with DBG horticulture department staff for internal discussions, from which I took notes.) The sessions began with the participants explaining how their particular garden accomplished things. Then the OBG staff presented their planned course of action, followed by a lively discussion on which methods best fit their garden plan. After a certain point, a pleasant rhythm developed as each topic was explored.

On the last day, we went out into the field to the northern mountains to see several vegetation types. The two-and-a-half-hour drive took us from sea level to about 6,000 feet in altitude. I was most fascinated by the historic agricultural terraces built on steep hillsides, with ownership held by individual families. We learned that one person, holding the title of “Guardian of the Water,” has the responsibility of regulating the water’s flow down through the aqueducts. Each landowner is also charged with keeping his ditch clean



Another view of the wet wadi.



One of the small towns we drove through on the field trip.



Juniper and olive tree woodland, one of the seven habitats.



Close-up of Juniper and olive trees.

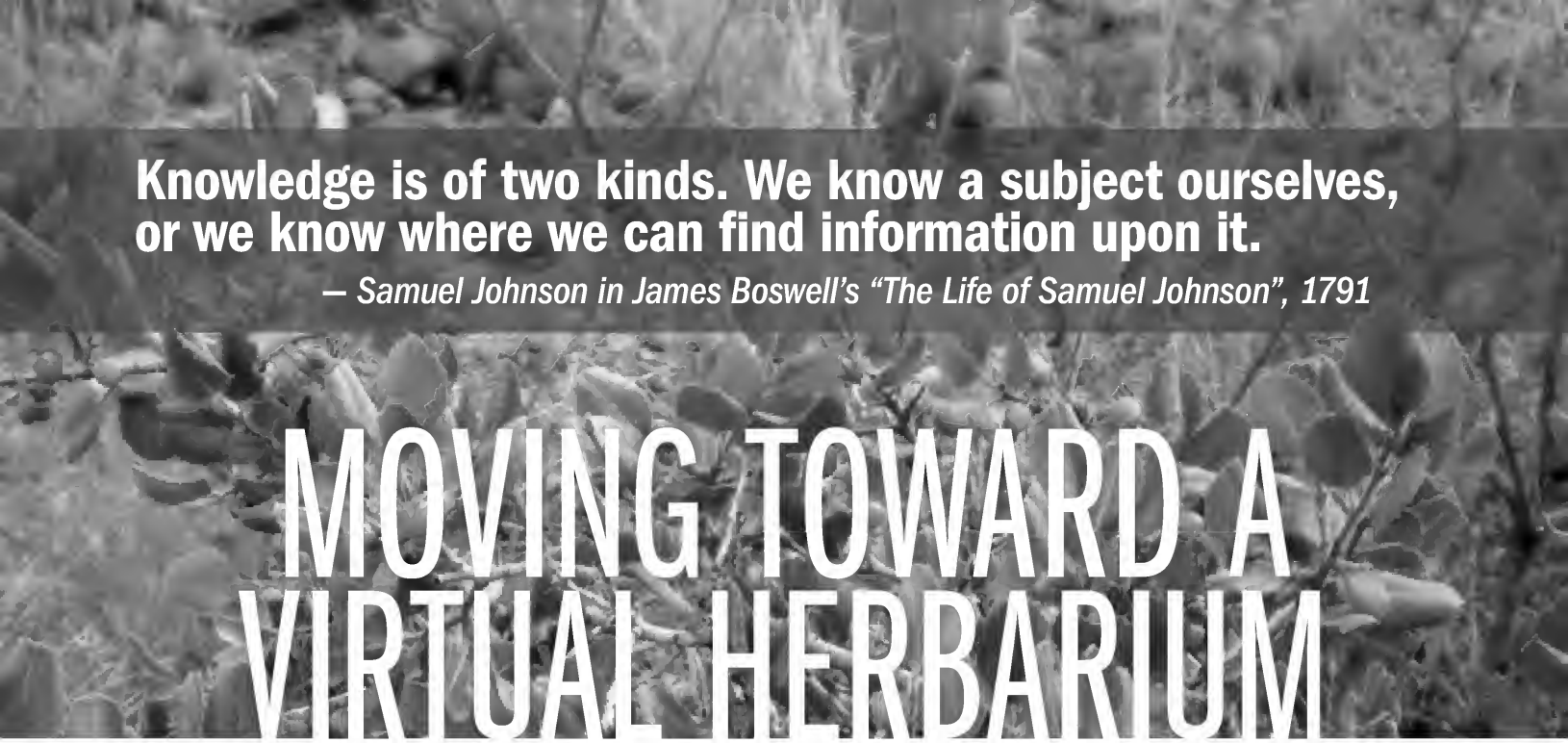
of debris so that the one on the bottom doesn't end up with a lot of trash. Families grow millet, barley, pomegranates, onion, garlic, fruit trees, and roses, to name a few crops. Upon my return to Arizona, one of the questions I was most frequently asked concerned the OBG's water source, which is a primary concern in any desert environment. There are two wells on site, one of which will soon have water available, but which have a high salt content. Eventually the OBG will desalinate its water on site, but currently desalinated water is trucked in. The garden is investigating the use of treated water as much as possible and is currently working on a water management plan.

Future Collaboration?

All in all, everyone felt that this was a worthwhile endeavor. We contributed many years of accumulated knowledge to Oman Botanic Garden, supplying them

with our experiences in similar climates. The workshop also confirmed many of their own thoughts. Additionally, we discussed the possibility of an "Arid Botanic Garden Group," with this workshop being merely the first of many. Discussion is underway on how to proceed. It may be as simple as starting up a chat room online, with other arid zone gardens invited to participate.

If another workshop were to be held in Oman, and there are whispers of a planting workshop, I would definitely plan to include a couple of extra days. In my opinion, the most interesting plants in the country are in the Southern Mountains habitat, and to be able to go on a field trip to that area would be this horticulturist's dream-come-true. I would also add a day just for sight-seeing; time was so limited that there was no opportunity for exploring or shopping. As Melissa Etheridge sings, "No Souvenirs."



Knowledge is of two kinds. We know a subject ourselves,
or we know where we can find information upon it.

— Samuel Johnson in James Boswell's *"The Life of Samuel Johnson"*, 1791

MOVING TOWARD A VIRTUAL HERBARIUM

Throughout history, people with special knowledge of plants have shared it with others. Even before the development of written language, plant knowledge was passed from generation to generation by oral tradition. Some of the oldest written works from Egypt, Mesopotamia, India, Europe, and China, hand-written on parchment, papyrus, or thin slats of bamboo, describe plants and their medical uses. These books, called *herbals*, helped spread information on plant identification, preparation, and usage. They were often illustrated to aid plant identification. Before the Renaissance, the study of plants was closely tied to medicine and the priests and physicians who tended to the sick, so herbals were not widely circulated, and because they were handwritten, relatively few of them existed.

With the invention of the Gutenberg printing press in the mid-1400s, there was a gradual yet dramatic rise in literacy in Europe – a kind of “democratization of knowledge.” The printing press led to a blossoming in the number and quality of Western European herbals during the next 200 years. There was a gradual trend to organize the herbals based more on the plants’ physical similarities rather than their medicinal properties, and to include plants that were not medicinal. With this, botany became an independent science distinct from medicine. It was during that time that people began to press and dry plants, and mount them on paper for study and to serve as a lasting record. These scientific or educational collections of pressed, dried plants for reference are called *herbaria* (See “The Garden’s Herbarium—Not Just a Collection of Pretty Pressed Plants” *The Sonoran Quarterly*, March 2007 for an

overview of the Garden’s herbarium).

Starting in the 1600s, when the on-going development of herbaria coincided with the exploration of foreign lands, herbals evolved into a more descriptive and scientific format that catalogued plants growing in specific regions. These books, now called *floras*, usually contained botanical keys and line drawings to help with plant identification. Access to these valuable treasure troves of knowledge, however, was still quite limited and remained that way for several centuries. Scientists had to travel to each herbarium to view and gather the information from the collections, or the specimens had to be sent to the scientist’s institution for study.

Virtual Access

Today we are faced with unprecedented environmental and social challenges that may benefit from easier, faster access to the kind information that so many institutions have accumulated from the study of plants. Solutions may be found, for instance, in knowing which wild plant species are adaptable for agriculture, the rate of spread of invasive plants, those that may have pharmaceutical value, or the distribution of rare plants.

While herbaria and floras are still the foundation for studying the distribution and diversity of plants, the methods for using and accessing their information have taken a huge leap forward with the advent of the Digital/Information Age. The widening impact of the Internet on society and science has been compared to that of the development of writing, and of the printing press. Rapid advances in science are now occurring as much by the application of this new technology

by Andrew Salywon, Ph.D., Assistant Herbarium Curator and Research Botanist

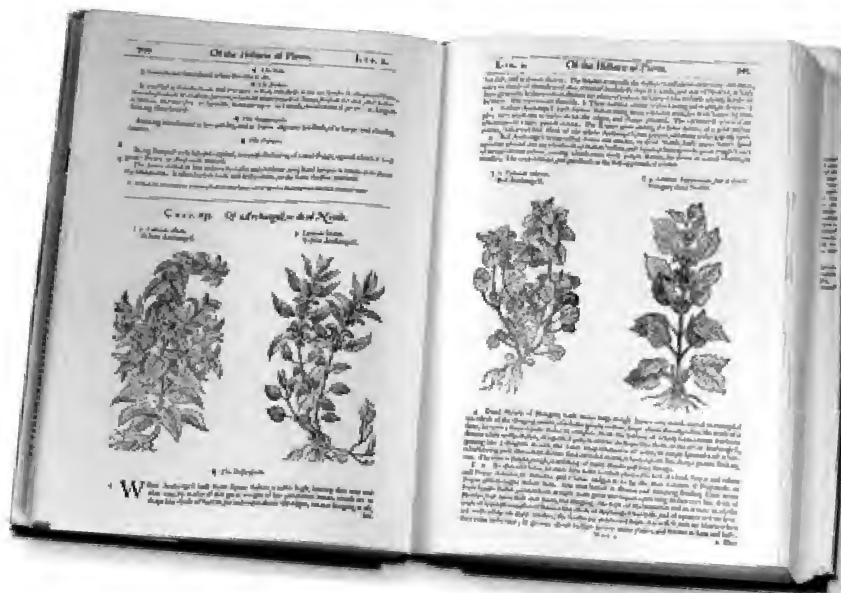
to scientific questions as by the development of new scientific theories. This is especially true for herbaria, where the power of the Internet is being used to "dust off" the specimens.

The Garden's Herbarium has been at the forefront of this revolution in plant information-sharing by virtue of its membership in the Southwest Environmental Information Network (SEINet); it has been a partner with SEINet since its inception nearly ten years ago. SEINet is a consortium of twenty natural history specimen databases that are organized and searchable via the internet (www.swbiodiversity.org).

A Valuable Grant Award, Part One

In September, the Garden's Herbarium was awarded a National Science Foundation (NSF) grant to expand and broaden the availability of plant knowledge on the Internet. The grant, titled "Collaborative Research: Expanding SEINet," was submitted by Wendy Hodgson, curator of the herbarium, and me, assistant curator of the herbarium, in conjunction with Drs. Les Landrum and Corinna Gries from the Arizona State University Herbarium and ASU Lichen Herbarium, respectively.

The Garden's portion of the grant is a three-year award totaling \$110,500. The scope of work is to digitize (make digital images), database, and georeference (provide latitude and longitude



Pages from a reproduction of John Gerard's 1633 edition of *The Herball or Generall Historie of Plantes* in the Garden's Library. Photo by Abby Medina.

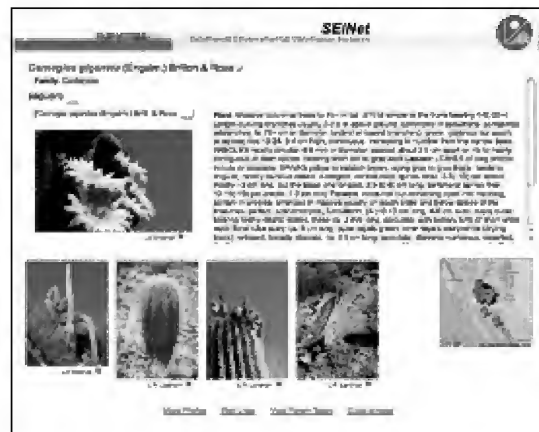
coordinates) all of its holdings, and to hold two workshops to train primary and secondary school teachers in the use of the resources available on SEINet.

The NSF grant will enable us to be at the cutting-edge of museum-based informatics (information science) by helping to create a virtual herbarium—meaning that all of our specimens will be represented by digital images, databased, and available via the Web. Access to the Internet will allow anyone with an interest in plants to view and make use of our collection.

Traditional methods for databasing older collections are time consuming, which is why most herbaria are not fully databased. For example, only 35% of the Garden's 65,000 specimens are databased, which is where the NSF grant comes in. Using NSF funds, we are going to take a picture of every specimen in the herbarium and then use newly developed software to convert the picture of the specimen label into text data, which is then easily transferred to the database. The software, developed by Dr. Les Landrum and Daryl Lafferty at ASU, is called SALIX (Semi-Automatic Label Extractor system); it is expected to significantly reduce the amount

of manual typing, which will in turn reduce input error. The picture of the specimen and label data will be available in the database image library for viewing and data proofreading.

By serving as one of the first users of the novel software SALIX, and by providing feedback to the developers, our herbarium and staff are playing a



SEINet webpage for saguaro (*Carnegiea gigantea*) that shows the species description, sample images and distribution map. Each image can be enlarged by clicking on it.



Herbarium cabinet with filed plant specimens. As part of our NSF grant, each specimen will be photographed and databased and made available on the SEINet website. Photo by Andrew Salywon.

crucial role in improving methods for widening the availability of scientific data. As there are more than 1,100 herbaria worldwide and some have over one million specimens, we will be at the forefront of implementing technologies to make herbaria data more accessible with lower costs and greater speed.

It is our hope that with the data from the herbaria in SEINet and the tools contained within it, botanists, ecologists, land managers, amateur botanists, and the general public will appreciate the resources that are just a computer click away.

NSF Grant, Part Two

It is clear that data based on herbarium specimens is entering the Information Age and is becoming easily accessible. That is great for botanists, but you may be asking, "What does this have to do with non-scientists?" That is where the second element of the NSF-funded project will come into play because, for the broader community, SEINet is designed as more than just a database. It is designed as a teaching tool for educators, as well as for self-learning. Some of the tools available on SEINet include:

Checklists will allow you to make species comparisons and identifications. So, you can list every species for the whole state or those of a smaller area like Picketpost Mountain, near Superior, Arizona.

Images for every species, and soon for every specimen, in the herbarium will allow you to make species comparisons and identifications.

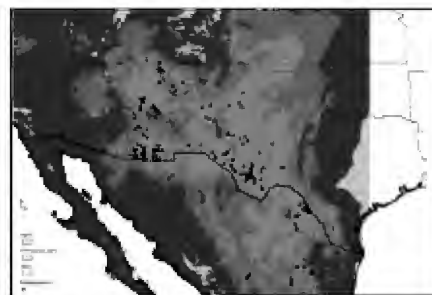
Mapping tools to generate species distribution maps for a plant species or for comparing the distributions of more than one species at a time. The dots that are generated on the map are *clickable*, allowing you to see the specimen information for that collection.



Print out a list of the plant species for an area for your next hike with the tools available on SEINet. (Picketpost Mountain pictured). Photo by Wendy Hodgson.



Need help identifying this plant? Use the interactive key and digital images on SEINet for quick and easy results. (*Rhamnus crocea*, Rhamnaceae). Photo by Andrew Salywon.



Distributional data from herbarium records can be used in conjunction with climatic and soil data to predict the ecological niche of a species.

Identification Keys that are interactive and will allow you to check off simple plant characteristics from a checklist to dynamically generate a list of plants with the selected characteristics. For example, by choosing given selections for *plant habit*, *flower color*, *leaf shape*, *inflorescence* one can pare a list of species from Arizona down from thousands or hundreds to just a handful. For those interested in a more detailed account of SEINet's functions and use, I recommend downloading the document "Making good use of SEINet" (Landrum et al. 2006).

As part of the NSF grant, the Garden, in conjunction with ASU, will host two workshops for teachers of Native American and inner city students with the purpose of training them on how to bring plants and

fieldwork into their classrooms. Even if the teachers do not have physical access to natural history collections or books for plant identification and geography, they can still easily share the exciting world of plants with their students.

It is our hope that with the data from the herbaria in SEINet and the tools contained within it, botanists, ecologists, land managers, amateur botanists, and the general public will appreciate the resources that are just a computer click away. It makes museum specimens, previously available to only a few people, virtually available to anyone with Web access—www.swbiodiversity.org.

Landrum, L. R., E. E. Gilbert, R. T. Schroeder and E. Makings. 2006. Making good use of SEINet. (symbiota.org/nalichens/collections/misc/SEINET_23Oct06.pdf).



Insider's Guide to Spring Butterflies

This spring the Desert Botanical Garden will host its 9th annual Spring Butterfly Exhibit in the Marshall Butterfly Pavilion. The seasonal exhibit features a lush garden enclosure filled with shimmering butterflies of all sizes and shapes – some flying, some perched in sunny locations, some seeking moisture and minerals from mud baths, and others feeding at nectar sources from flowers, oranges and fruit juice.

Since the opening of the exhibit in 2002, we have exhibited more than 95,000 butterflies, which arrive via FedEx from butterfly farms in Florida and California. Painted ladies, fiery red admirals, white peacocks, zebra swallowtails, and an exquisite array of moths are just a few of the delightful creatures that have enthralled the thousands of visitors to the pavilion.

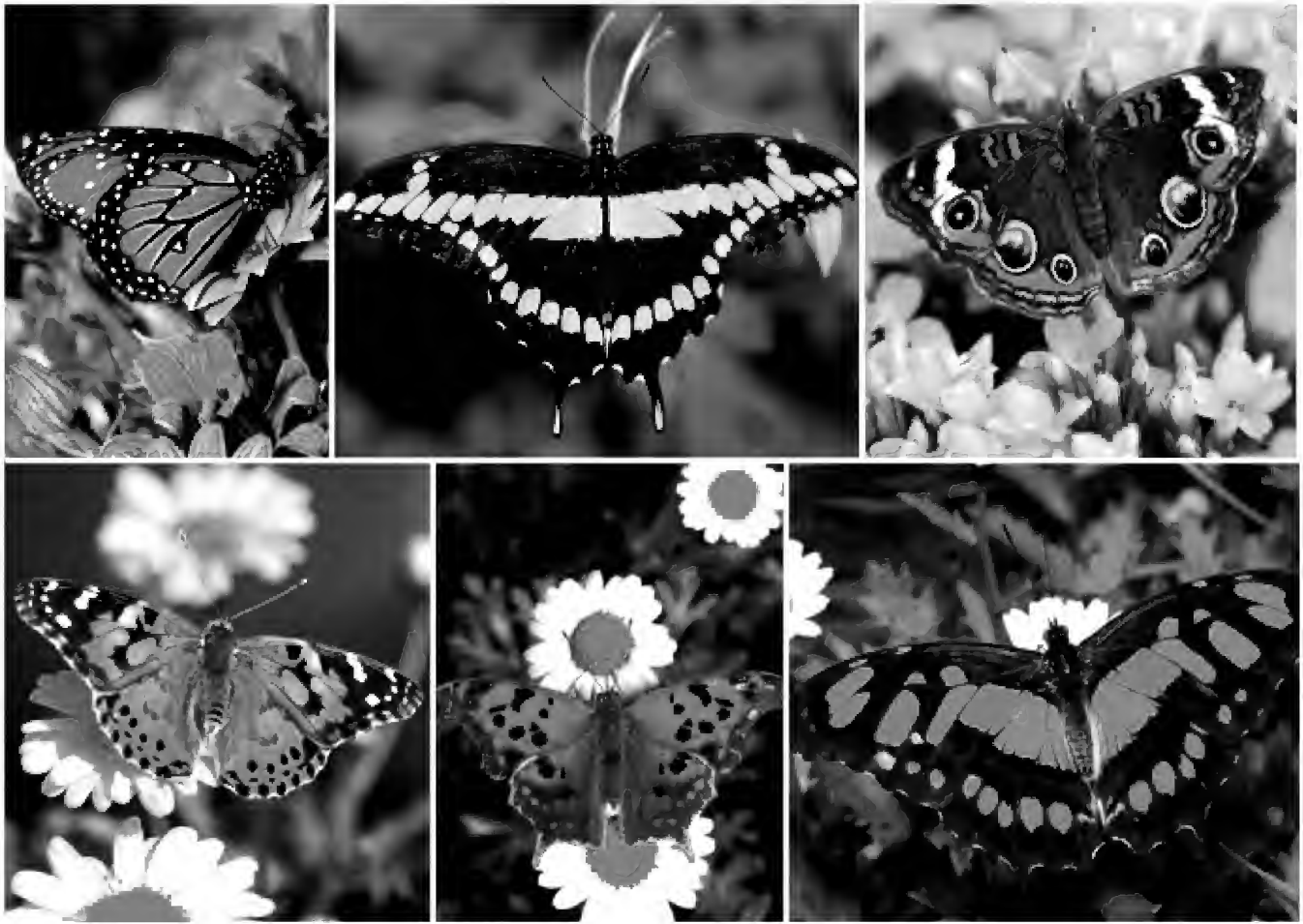
All over the world, butterflies are valued for their beauty and as symbols of rebirth, awakening, and freedom. They currently inhabit every continent except Antarctica, and appear in art and folklore in cultures around the globe. Butterflies first evolved roughly 100 million years ago, about the time that flowering plants evolved. Of the approximately 20,000 species of butterflies in the world, about 700 species are found in North America. In the United States, Arizona is second only to Texas in its number of butterfly species. There have been 330 species documented in Arizona, with the greatest diversity in the southeastern part of the state.

Butterflies are colorful, dainty creatures that belong to the Lepidoptera order of insects. Because of their beauty and delicate nature, you may be surprised to learn that they are distant relatives of termites, ants, and bees. They are cold-blooded and thus dependent on the weather and warm sun to regulate their temperature. Ideally, they need temperatures near 70 degrees to fly. Butterflies are important pollinators as well as a delight to see in any garden.

Each year I enjoy spending time in the pavilion observing the reactions of our visitors to the butterflies, especially the children who squeal and laugh as a butterfly lands on their hair, shoulder, or shoe. There have been several proposals of marriage in the pavilion and reports of people who seek out the exhibit for relaxation, healing, or refuge.

Planting your own butterfly garden is easy and a garden that includes plants for the entire lifecycle will attract a variety of native butterflies. There are three types of plants that are essential for a butterfly garden: those that provide nectar for adult butterflies, host plants that provide food and camouflage for the caterpillars, and those that provide shelter from wind and predators.

by Elaine McGinn, Director of Planning and Exhibits



Top row left to right: Queen Butterfly, Giant Swallowtail, Buckeye. Bottom row left to right: Painted Lady, Question Mark, Malachite. Photos by Adam Rodriguez

Here is a list of the Marshall Butterfly Pavilion favorites, some of which are also native to Arizona:

Queen Butterfly / *Danaus gilippus*

The queen butterfly is one of the common butterflies at the Garden and is present for most of the year. Similar in color and size to monarchs, they are frequently found in Arizona and other southwestern states. The caterpillars feed on milkweed plants (*Asclepias* spp.), which contain poisons that are stored in the bodies of both the caterpillars and adults, affording them protection from birds and other predators.

Black Swallowtail / *Papilio polyxenes*

Medium in size, the black swallowtail is indeed mostly black with yellowish-white dots and crescents. Found throughout the American continent, including Arizona, they prefer open spaces including gardens and meadows. Host plants include dill, celery, parsnips, umbels, and turpentine-broom.

Pipevine Swallowtail / *Battus philenor*

The medium-sized, short-tailed pipevine swallowtail can be found across the United States. It can be seen in Arizona most of the year. With black forewings, it is easily recognizable by the iridescent blue of its upper hind wings. Host plant: pipevine (*Aristolochia watsoni*).

Giant Swallowtail / *Papilio cresphontes*

One of the largest and showiest butterflies, the giant swallowtail can reach a wing span of over seven inches. This beautiful butterfly can be found across North America, although because the caterpillars eat the leaves of citrus it is often regarded as a pest in citrus growing areas. A female can lay as many as five hundred eggs at a time. Host plant: prickly ash (*Zanthoxylum* spp.), cultivated citrus.

Viceroy / *Limnitis archippus*

With its orange and black coloration, the viceroy mimics the monarch and queen butterflies. The key difference in indentifying the viceroy is the horizontal black band that connects across its hind wings. They range throughout North America. Host plant: willow.

Common Buckeye / *Junonia coenia*

Buckeyes have iridescent blue and lilac eyespots on their brownish-gray wings. They are prevalent in Arizona from the desert floor into the pine woodlands. Migrations of buckeyes occur in the autumn on the east coast of the United States. Host plants: owl's clover, plaintains, *Gerardia*.

Painted Lady / *Vanessa cardui*

The small painted lady, with its three-inch wing span, can be found in the Sonoran Desert throughout the year. It has distinct differences between its upper and under sides: the upper side is salmon-orange with black spots and blotches, and the underside is a pattern of pink, olive, black, and white. The painted lady is the most widely distributed butterfly in the world, appearing on all continents except Australia and Antarctica. Host plants: thistles (*Cirsium* spp.).

Question Mark / *Polytonia interrogationis*

This butterfly got its name because of the silvery mark on the underside of its hind wing, which is broken into a curved line and a dot. Question mark adults prefer to drink sap and eat rotting fruit. They occur in isolated mountain areas in Arizona.

Cloudless Sulphur / *Phoebastria sennae*

The small cloudless sulphur is a frequent visitor to the Garden during summer and fall. It lays its eggs on desert senna (*Senna covesii*), slim pod senna (*Senna leptocarpa*), and other sennas. Its range is from southern United States to Argentina.

Malachite / *Giproeta stelenes*

While this tropical beauty is not seen in the wild in Arizona, it is everyone's favorite butterfly in the pavilion. It appears only in southern Florida and Texas and is thought to have immigrated to the United States from Cuba. The distinctive wings have yellow-green markings against a rich black background, making this one of the most spectacular North American butterflies on display.

We hope you will visit and enjoy the Spring Butterfly Exhibit in the Marshall Butterfly Pavilion. Maybe it will inspire you to plant your own butterfly garden in your backyard. Butterfly host plants will be available at the Spring Plant Sale held March 19-21.

The Spring Butterfly exhibit is generously supported by Wells Fargo and the Fred Maytag Family Foundation.



Spring butterflies are beginning to appear in the Garden, and with their appearance we pay special tribute to Jonathan Marshall. His passion for nature along with his interests in conservation, exhibits, and education led to support for the butterfly exhibit named the Maxine and Jonathan Marshall Butterfly Pavilion. Jonathan Marshall passed away in December 2008, but his estate plan included a charitable legacy for the butterflies that he and especially his wife, Maxine, loved.

Both Maxine and Jonathan Marshall took great delight in the Marshall Butterfly Pavilion that bears their name. In the spring of 2004, their generous charitable gift supported pavilion enhancements and plant displays. In six intervening years, the Marshall's sponsorship of the exhibit continued to captivate growing audiences of children and adults. Visitors learned to identify a growing variety of spring butterflies, tracked the monarch's fall migration, discovered favorite butterfly plants, and ways to attract these pollinators. The Marshall Butterfly Pavilion both engages and educates visitors, provoking delightful moments of discovery and wonder.

Michael W. Sillyman, Garden trustee and the Marshalls' longtime friend, comments: "Jonathan Marshall was an extremely generous man. He and Maxine loved the Garden and Maxine was particularly interested in a butterfly exhibit. Jonathan wanted their contribution to the Marshall Butterfly Pavilion to be in Maxine's name. It is a living testament to a great man and the generosity of a wonderful couple."

Mr. Marshall's charitable legacy provides for continued maintenance and improvement of the Garden's Butterfly Pavilion. The Garden is deeply grateful for this thoughtful gift.

by Susan Shattuck, Gift Planning Officer



AT HOME IN YOUR Moths and other Unsung Pollinators DESERT GARDEN

Moths are the Rodney Dangerfields of the insect world: they get no respect. Although there are ten times more species of moths than there are of butterflies, it is the rare person who has ever bought a field guide to the moths. They have a mostly negative image that is often associated with acrid-smelling mothballs and ruined woolen sweaters. When we think of insects that pollinate flowering plants, beautiful butterflies and industrious bees usually come to mind. Moths, however, actually pollinate many plants including the sacred datura, all of the yuccas, and several species of night-blooming cacti.

by Tom Gatz, Garden Docent and Horticulture Aide

Perhaps equally low on the lovable insect scale are the unheralded beetles, which are actually responsible for pollinating almost 90 percent of the world's flowering plants. When asked what he could say about the Creator from his study of nature, biologist JBS Haldane replied, "He must have an inordinate fondness for beetles." This comment was driven by the fact that there are almost as many described species of beetles as all the rest of the insects put together, about 350,000 known species and still counting. So don't be too quick with that bug spray the next time you see something crawling toward your plants, because many of our favorite flowering plants and important food crops depend on these underappreciated and, in recent years, often declining insect pollinators.

As city dwellers, we sometimes forget that all fruit, whether on yucca plants or on apple trees, started out as flowers that needed to be pollinated. Many plants display colorful and often scented flowers to attract insects and other pollinators so that their flowers will be pollinated; this leads to the eggs within their flowers being fertilized, thus enabling them to develop into fruits. The insects benefit by obtaining nectar and pollen for food and, in some cases, they extract chemicals from the flowers that act as sexual lures (sort of like a flowery aftershave lotion for insects) to attract mates. The colorful and often sweet fruits in turn attract other birds and animals to consume them and transport the other seeds within the fruits to new locations, ensuring the spread of the plant species. In essence, the plants are using all sorts of tricks including colors, sweeteners, and perfumes to entice birds, bugs and yes, even humans, to do their bidding.

A Moth Mystery

Prior to the 1930s, there was a natural population of yuccas right here in Papago Park. In their book *The Forgotten Pollinators* (1996), Drs. Stephen Buchmann and Gary Nabhan (former Garden assistant director for research and research ethnobotanist) mention finding old photos of Papago Park showing that banana yuccas (*Yucca baccata*) were once a prominent feature of the natural vegetation here. They are not completely sure what happened to them, but with an increase in development and other human activity, a reduction in natural predators and the attendant increase in rodents and rabbits, the wild yuccas have disappeared from the park. Also, according to Chad Davis, the Garden's curator of Agavaceae and Aloaceae, in spite of the large number of cultivated yuccas at the Desert Botanical Garden, only three of them have ever been known to be pollinated, producing a total of only four seed-bearing fruits.

How could this be, with all the birds, bees, butterflies and other pollinators around? It turns out that yuccas have a very specific and almost unique relationship with tiny, white yucca moths, a species that apparently disappeared from the Phoenix area



In spite of the large number of cultivated yuccas at the Desert Botanical Garden, only three of them have ever been known to be pollinated, producing a total of only four seed-bearing fruits.

Yucca jaegeriana in the new Berlin Agave Yucca Forest.

along with the original wild yuccas in the park. Drs. Buchmann and Nabhan speculate that either the yucca moths locally died out as the natural yucca population declined, or the number of cultivated yucca plants at the Garden is not yet large enough to sustain a viable population of yucca moth larvae.

Unlike many other flowering plants that attract a variety of pollinators, every species of yucca is totally dependent upon one or more species of yucca moths for pollination. The moths, on the other hand, need the developing yucca seeds to feed their larvae, a tongue-twisting arrangement known as "obligate pollination mutualism"—only about one percent of all flowering plants have a single obligate pollinator species. This tight relationship is very rare in nature since there is an obvious peril to such exclusive matchmaking if one of the partners fails to show up.

The yucca moth is one of the few known pollinators (the senita moth on the senita cactus is another recently discovered example) that intentionally pollinates a flower for the sole purpose of creating a seed-bearing fruit for its larvae to feed upon; most insects pollinate flowers inadvertently while harvesting nectar and pollen to take elsewhere. In exchange for its pollination services, the moth is ensured a supply of nutritious seeds for its voracious



Clockwise from left: Joshua tree, *Yucca jaegeriana*, Yucca Blossoms, Cecropia silkmoth, *Hyalophora cecropia*, one of the largest moths in North America. Yucca moths, *Tegeticula yuccasella*, on a *Yucca filamentosa* flower.

larvae developing within the immature fruits. Only a few eggs are laid in each yucca flower ovary, so that only a few of the developing seeds are eaten, ensuring that enough seed remains for successful yucca reproduction.

Researchers have found that if a moth either under-pollinates a yucca flower or over-burdens it with too many moth eggs, the yucca responds by aborting the flower and these moth larvae starve. As a result, natural selection has favored yucca moths that both pollinate yucca flowers and deposit only a few eggs so the abort response is not triggered. Recent research by yucca moth expert Dr. Olle Pellmyr and his colleagues has revealed other intriguing insect dramas including the existence of *cheater* moth species. These cheater moths don't do any pollinating at all, but instead take advantage of the yucca moth's pollination efforts by depositing their

own eggs into the already developing yucca fruits. Once the fruits have started to develop, the abort response in the yucca has already been cancelled, enabling the cheater moth larvae to survive.

Hope for a Return

The new *Berlin Agave Yucca Forest* features about twenty different species of yucca and *hesperoyucca*. *Hesperoyucca* is a small genus of three species closely related to, and recently split from, the genus *Yucca*. Several of these species will be available for purchase at the Garden's spring plant sale. Some of Chad Davis's favorite yuccas for landscaping are the pale 3 x 3 foot *Yucca pallida* for smaller spaces and the taller blue-gray 15 x 15 foot *Yucca rigida* and 15 foot tall x 8 foot wide *Yucca rostrata* for great focal points in your landscape. With the increase in yucca species and numbers

at the Garden in the *Berlin Agave Yucca Forest* and with future restoration efforts, perhaps the yucca moth will one day return to its proper role here as a pollinator, and the yuccas will once again be able to reproduce on their own.

There is a saying that insects will inherit the earth, but people who study them know better. In a recent issue of *Smithsonian* magazine, Clint McFarland observed that "The earth already belongs to the insects...they are in nearly every inch of soil. We wouldn't be here without them—without pollination and decomposition. The earth is theirs. We're just trying to share it for a while."

Acknowledgements: Thanks to Dr. John Alcock, Chad Davis, Wendy Hodgson, Barbara Larson, and Dr. Ronald Rutowski for helping me with this article.

TOWER

FOR THE PEOPLE!

KEEP CHIHULY ART AT THE GARDEN



WE CAN SAVE THE
TOWERS PERMANENT
INSTALLATION FOR
ALL TO ENJOY

The Desert Botanical Garden seeks your support to acquire and permanently display the stunning glass sculpture of renowned artist Dale Chihuly. Created in 2008 to be displayed in the Garden's entry, the sculptures are currently on loan from the Chihuly Studio.

The Garden's goal is to raise \$1 million by June 2010 in order to purchase the artwork and provide an endowment for future care and maintenance of the sculptures and their setting.

Located outside of the Admission area, the sculpture is completely accessible making it a permanent and viable piece of public art for the metro Phoenix area.

The Garden welcomes your participation in the drive to preserve the *Desert Towers*. Let's keep this one-of-a-kind sculpture installation for all future visitors to enjoy!

For more information on how to help, call Danielle Vannatter at 602-481-4811 or visit dbg.org/chihulytowers



Clockwise from left: Allan Houser, *Family Planting a Field*, 25.5" x 12", tempera, Allan Houser, *Boy in Landscape with Animals*, 13" x 20", pen and ink; Allan Houser, *Cattle Drive*, 27" x 15", tempera; Allan Houser, *"Tuna" Harvest*, 14.25" x 21", tempera. Illustrations are from *The Desert People*, 1962. ©Chiinde LLC, Photos courtesy of Allan Houser, Inc.

Allan Houser Drawings at Ottosen Gallery

A special exhibition of rare Allan Houser two-dimensional works on paper will be featured in Ottosen Gallery beginning in late January and running until May 31.

These tempera paintings and pen and ink drawings, many of them relating to the desert and its plants, were originally used as illustrations in children's books. They are considered among the most important examples of original artworks used in the genre of American Indian children's books. The stories ranged widely from documenting famous lives in Apache history (*Geronimo*, 1952, and *Cochise: Apache Warrior and Statesman*, 1961) to fictional personal journeys (*Runner in the Sun*, 1954; *Joe Sunpool*, 1954; *The Cave*, 1958).

The illustrations selected for the exhibition feature lavish tempera paintings from the 1954 book *Blue Canyon Horse* and vibrant images from *The Desert People* (1962, Viking Press). The original tempera paintings used in *The Desert People* aptly illustrate the mission of the Desert Botanical

Garden: in portraying the traditional life of the Tohono O'odham, the book chronicles the timeless relationship of the plants of the desert and those who live among them.

In 2004, Allan Houser was honored by the Smithsonian with an inaugural exhibition at the National Museum of the American Indian, recognizing his unique role in 20th century American Art. Self-trained as a sculptor, his unique approach to form became the basis for a transformational career as an artist, and his 60-year span made him a mentor for generations of artists.

The Allan Houser exhibition is generously supported by

The Virginia M. Ullman Foundation

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Plan to visit the Garden and enjoy both the *Allan Houser: Tradition to Abstraction* sculpture exhibition and this remarkable collection of paintings and drawings.

by David Rettig, Curator of Corporate Collections, Allan Houser, Inc.

Garden Profile: Hort Aides

Horticulture crews, or hort aides, work Tuesdays through Fridays. They are the volunteers who support the horticultural staff in maintaining, nurturing, and propagating the plants of the Desert Botanical Garden.

You will recognize them out in the Garden: they are at work among the plants, down on their knees, hands gloved, trimming dead flowers and generally tidying up an area, their yellow utility carts piled high with debris. You might find them in the greenhouses potting plants, or mixing soil behind the tool shed. Their hours fluctuate with the seasons; they come in earlier during the heat and later during the cold. They come ready to haul dirt, dig holes, spread compost, and water plants. Just like all of the Garden's volunteers, the hort aides are dedicated to their work. Furthermore, there are a lot of them, and they make a big difference.

There is specialization within the hort crews. There are the Irrigation Boys, the Agave Guys, the Arborettes, the Propagators, and the Generalists. Each group works closely with a horticulture staff member to accomplish that day's work. With 65 acres requiring horticultural care, there is always something to do, regardless of the season. There is a great amount of job satisfaction in being a hort aide. To see the difference your efforts make over time is very fulfilling. Plus you get to work outside and use all kinds of tools!

The hort aides have become a valuable asset to the Garden. This fact became particularly noticeable during the creation of the *Berlin Agave Yucca Forest*. The Agave Guys had spent the preceding year growing agaves for this exhibit. The plans called for over 450 agave specimens. The Irrigation Boys helped lay yards of tubing from which they ran smaller drip lines to all the plants. That meant trenching through hard, rocky soil on hot summer days. The hort aides helped with the planting of over 1,000 plants. The pick axe was the most frequently used tool during that phase of the project! With the significant contributions of the volunteers, this marvelous exhibit was completed on time and on budget. Exhibit underwriters Howard and Joy Berlin, appreciative of this effort, dedicated the exhibit to the Garden's hard-working volunteers and staff.

Could the horticulture department function as effectively without the hort aides? Maybe, but I don't think anyone wants to find out!



by Dawn Goldman, Volunteers in the Garden President

Celebrating a Milestone



This year we celebrate Wendy Hodgson's 35 years of service to the Desert Botanical Garden. Her record-long career spans half the number of years of the Garden's existence, which has benefitted tremendously from her study of, and passion for, plants.

Wendy's work at the Garden began in 1974, when Dr. Howard Scott Gentry hired her to illustrate his book *Agaves of Continental North America*. During Wendy's early years at the Garden, she performed in many other capacities including in horticultural care of plants and as an assistant to the education department. After serving as an assistant curator of the herbarium for several years, Wendy became curator of the herbarium in the mid-1980s and has remained so to this day. Her botanical research has led to descriptions of five new plant species, including three new agaves. Her work also contributes to a better understanding of many aspects of the natural history and ethnobotany of plants throughout the Southwest, as seen in her book *Food Plants of the Sonoran Desert*, which was published in 2001 and was the winner of the Klinger Award from the Society for Economic Botany, awarded to the top book in economic botany published in that year. Whether it is through her excellent management of the herbarium collection, or her participation in creating public exhibits like the new *Berlin Agave Yucca Forest*, Garden programs bear the indelible stamp of her work and contributions.

Wendy's own words express the bonds that are formed by such a long association: "I am so grateful to all the people who unselfishly shared their wisdom and knowledge with me, and who helped open the doors that provided the many opportunities for me to follow my passion. The Garden is my second home, and I will always be thankful for the opportunity and privilege of working here."

Thank you, Wendy, and congratulations!

15th Annual Scottsdale Artists League Spring Paintout and Sale March 6 - April 4, 2010

Saturdays / March 6, 13, 20, 27
9 a.m. - 3 p.m. throughout the Garden

Show & Sale / Friday-Sunday
April 2 - 4 / 9 a.m. - 3 p.m.
Stardust Foundation Plaza

The Desert Botanical Garden and Scottsdale Artists League will co-sponsor the annual **Spring Paintout**. More than forty Scottsdale Artists League's best landscape artists will paint every Saturday in March. As visitors walk through the Garden trails, they will come across artists painting Garden scenes. Visitors are encouraged to interact with the artists and see art and nature in new ways.

Be sure to return during the final weekend of April 2-4 when all of the artwork from the paintout will be on display and for sale. A portion of the proceeds from the sale will benefit the Desert Botanical Garden and the Scottsdale Artists League's Scholarship Fund. For more information, visit www.scottsdaleartistsleague.org.

Save the Date!

Golfin' in the Desert, May 8, 2010
at ASU Karsten Golf Course

Volunteers in the Garden announces its annual golf tournament. Sign up now to enjoy a fun day of golf while contributing to this popular fundraiser for Title I schools. Contact nwhite@dbg.org or go to dbg.org/golftournament to sign up.

Season for Sharing

This year, when guests of *Las Noches de Las Luminarias* purchased their tickets, they had the option of making a donation to Season for Sharing, *The Arizona Republic* and 12 News' annual holiday fundraising campaign. Thanks to generous donors, more than \$8,500 was raised for the program. Thank you for your generosity!



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Page 13 Zebra Longwing - Adam Rodriguez
Page 13 Inside the Marshall Butterfly Pavilion - Mary Versosky
Page 14 Prometheus silkmoth, *Callosamia promethea* - Adam Rodriguez
Page 16 Joshua tree and Cecropia silkmoth - Adam Rodriguez
Page 16 Yucca moths - Alan Cressler

Page 17 Desert Towers - Adam Rodriguez
Page 19 Hort aide, top and bottom photos - Renee Immel
Page 19 Hort aides, middle photos - Rosa Crespo
Page 20 Wendy Hodgson drying plants along the Colorado River, Grand Canyon - Tyler Williams
Page 23 Hummingbird - Adam Rodriguez
Back cover Ferocactus *latispinus* - Adam Rodriguez

The Virginia G. Piper Fellowship Awarded to Elaine McGinn

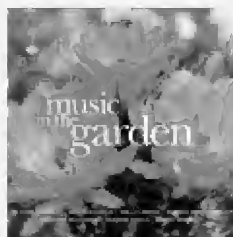
Elaine McGinn, director of planning and exhibits, has received a **Virginia G. Piper Fellowship award**. The Fellowship is awarded to non-profit leaders to enhance their skills, link to best practices, and refresh professionally. Elaine applied for a professional development opportunity under the Piper Fellows sabbatical program; her proposal was accepted.

The primary focus of her Piper Fellows Program will be an exploration of how design of gardens is influenced by social, cultural, and horticultural trends. Through a firsthand examination of gardens in Italy, Spain, and the United States, she will explore best practices in innovative design from both historic and contemporary perspectives. The goal is to broaden her understanding of the cultural significance of gardens in the Western world, allowing interpretation of that heritage to current practices of garden design at the Desert Botanical Garden.

The Piper Fellow Program will also provide funding for Garden staff development and an opportunity to apply for an organizational enhancement award.

Green by Design Award winners named

The Garden was presented a **Green by Design award from the Scottsdale Convention and Visitors Bureau in the "Greenest" category**. Businesses are recognized for this award in three categories: Green, Greener, and Greenest. It acknowledges Arizona businesses with green practices in place that exhibit promising efforts to help create a more sustainable community. One of the Garden's programs involves our green waste being composted off-site at Singh Farms; the finished material is then purchased for use within the Garden. This act alone removes nearly 180 tons of waste from the landfill yearly, and closes the loop between waste and product. Also, an increased number of recycling containers has enabled us to capture a larger quantity of recyclables that were previously discarded. In addition, purchasing and procurement is continually being evaluated, and numerous education and outreach programs with a focus on sustainability and conservation are offered to the public. These are just a few of the improvements made by the Garden in our efforts to become a more sustainable organization. Fourteen companies submitted applications for the Green by Design Awards.



Music in the Garden, Volume 1

In celebration of the Native American music that has filled Ullman Terrace over the years, the Garden has jointly produced an album with Canyon Records. *Music in the Garden, Volume 1* showcases the collaboration between the renowned Canyon Record label, its artists, and the Garden.

Featured artists on the thirteen tracks include Robert Tree Cody, Will Clipman, Anthony Wakeman, Randy Wood, William Eaton, Sharon Burch, and R. Carlos Nakai, to name a few.

The CD is available at the Garden Shop, SRP Visitor Center and online at dbg.org/migvolume1 and sells for \$16. All proceeds benefit the Garden.

Jan & Tom Lewis and Beverly Duzik Honored

Each fall, the Garden celebrates National Philanthropy Day by honoring a significant donor with its Spirit of Philanthropy Award.

On November 18, 2009, Jan and Tom Lewis received the Garden's 2009 Spirit award at the Philanthropy Awards Dinner, sponsored by the Association of Fundraising Professionals. Jan has served on the Board of Trustees since 2003, contributed more than 250 volunteer hours to a multitude of projects and, together with her husband Tom, has made a series of major contributions from the TW Lewis Foundation.

They have expressed their passion for the Sonoran Desert by investing in the Garden's permanent plant exhibitions. In addition, this dynamic couple has been active throughout the community in supporting a variety of endeavors including improved health care for Valley residents and providing full scholarships for 70 talented students to attend college.

Beverly Duzik, the Garden's director of development, was also honored at the dinner with a Leadership Award as the AFP Chapter's Outstanding Fundraising Executive for 2009. With more than 26 years of fundraising experience, she is considered by many community leaders to be among the best fundraisers in the state. Beverly's accomplishments at the Garden include leading the team responsible for increasing the Garden's membership base from 9,000 to 26,000 households, and managing the recent *Tending the Garden* Campaign, which raised \$17.8 million for initiatives in research, education, exhibits, and endowment.

in appreciation

The Desert Botanical Garden is grateful to all 26,134 members and donors for their support. Acknowledged in this section are annual Curator's Circle, Director's Circle, President's Circle and Founder's Circle members and donors giving \$2,500+, including memberships and unrestricted gifts to support the Garden's annual operations from December 1, 2008 through December 31, 2009.

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Patricia Dickerman
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Jonathan Marshall
Vera A. Carpenter Trust

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The Desert Botanical Garden
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*Those whose gifts have been realized.

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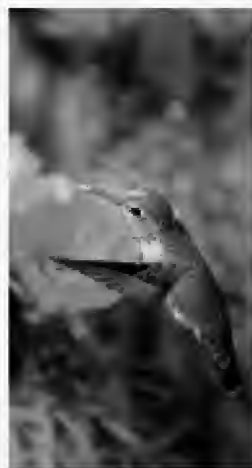
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The Mission Statement of the Desert Botanical Garden

The Garden's commitment to the community is to advance excellence in education, research, exhibition, and conservation of desert plants of the world with emphasis on the Southwestern United States. We will ensure that the Garden is always a compelling attraction that brings to life the many wonders of the desert.



SPRING 2010 PLANT SALE

Garden Members' Preview:

Friday / March 19 / 7 a.m. - 5 p.m.

Open to the Public:

Saturday March 20 / 7 a.m. - 5 p.m. AND

Sunday / March 21 / 9 a.m. - 5 p.m.

The Desert Botanical Garden Plant Sale is a one-stop shopping experience with one of the largest selections of arid-adapted plants available in a single location. Garden volunteers and horticulturists are on hand to answer questions, assist in plant selections and provide advice. Purchase pottery and other delightful garden accessories from specialty retailers. There is also a used book sale offering a wide variety of subjects with all proceeds benefiting the Garden's library. (*Book donations are accepted at Garden admissions at the front entrance. Sorry, no magazines.*)

No admission charge to enter the plant sale.

SONORAN QUARTERLY

FOR MEMBERS AND FRIENDS OF THE DESERT BOTANICAL GARDEN PHOENIX, ARIZONA JUNE 2010, VOLUME 64, NO. 2





The Coolest Place in Town

Let's face it. It's hot everywhere in the Valley in the middle of summer. So "cool" becomes a relative term. With that caveat in mind, consider this . . .



Because the Garden is an oasis of green in the middle of a huge metropolis, it doesn't suffer nearly as much from the heat island effect as surrounding areas do. When the hot summer sun begins to set, the Garden cools quickly and on most nights a gentle breeze kicks up. My favorite place to say goodnight to the summer sun is atop the *Sonoran Desert Nature Trail*. The view is great, the air stirs, and I can often sense the resident wildlife beginning to rouse.

The animals, like us, spend most of their summer days just trying to stay cool, and venture out at night

to forage for food and find water to drink. If you visit the Garden on a summer evening, and move slowly and watch carefully, you may see the kangaroo rats and pocket mice begin to go about their business. If you're lucky, you might also hear one of the many resident owls calling, or see a coyote lope along the side of the Garden butte.

This issue of *The Sonoran Quarterly* includes an article by Garden scientist Joe McAuliffe and volunteer naturalist Tom Gatz about some of the nocturnal residents of the Garden. Their adaptations for survival in the desert are remarkable, and I'm sure that you will enjoy reading about them. But try not to be an armchair naturalist this summer . . .

Come to the Garden some evening to cool off, and to watch the wildlife do the same. If you're really lucky and choose a night when the Queen of the Night cacti are in bloom, you will experience one of the most sublime scents the desert has to offer. No matter what you see, though, you'll be happy you came, because on a hot summer night the Garden is the coolest place in town.

Ken Schutz,
The Dr. William Huizingh Executive Director

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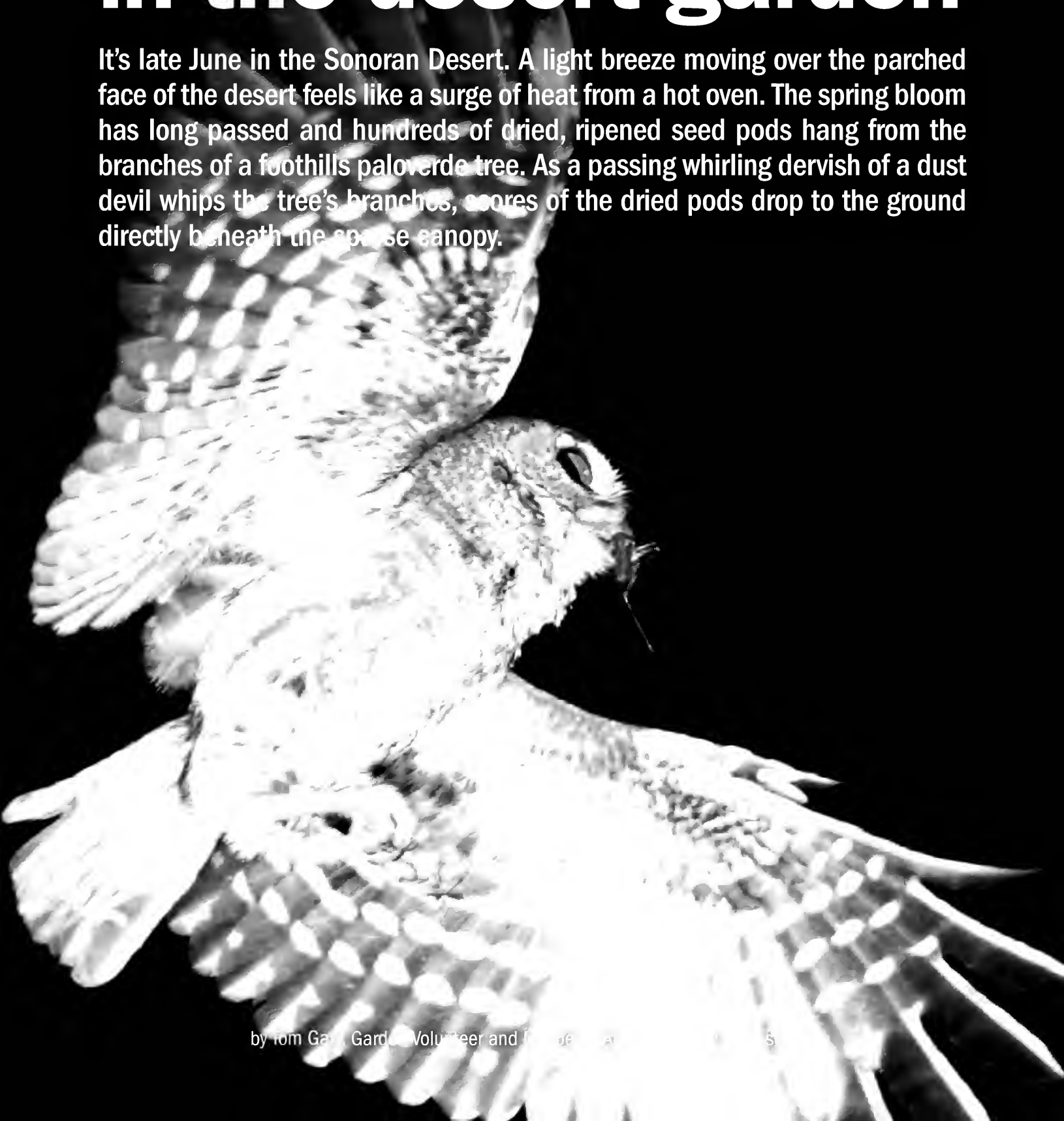
Sunset on Ottosen Entry Garden. Photo courtesy of Adam Rodriguez using high dynamic range imaging or HDR. This technique produces images with more detail in the highlights and shadows.

Back Cover

Register now for Desert Landscaper School 2010-2011

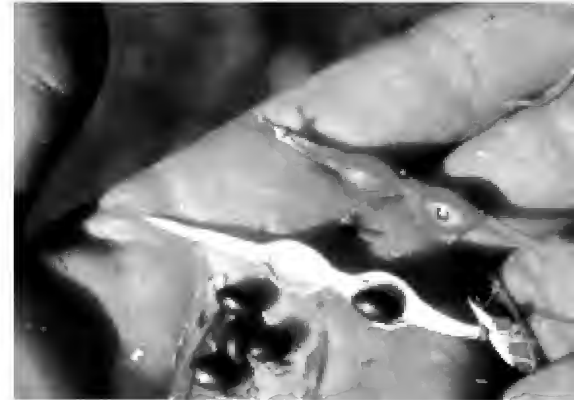
Nighttime Drama in the desert garden

It's late June in the Sonoran Desert. A light breeze moving over the parched face of the desert feels like a surge of heat from a hot oven. The spring bloom has long passed and hundreds of dried, ripened seed pods hang from the branches of a foothills paloverde tree. As a passing whirling dervish of a dust devil whips the tree's branches, scores of the dried pods drop to the ground directly beneath the sparse canopy.





Ripening seedpods of the foothills paloverde.



Dark brown, bean-sized seeds of foothills paloverde.

The oppressive daytime heat doesn't last forever, though, and as the fiery orb sets behind the mountains on the western horizon, many animals begin to stir. At dusk, all kinds of living things emerge and go about searching for the food they need to continue for yet another day. Desert rodents scamper to and fro. Some, like the packrats, eat the green, growing leaves and stems of plants. Others, like the kangaroo rats and pocket mice, eat almost nothing other than dry seeds during their entire lives, deriving nearly all the water they need from those seeds.

To seed-eating rodents, this harsh time of the year before the summer monsoon season is often a time of plenty. Although the desert may not have received a drop of rain for two months, seeds of many kinds of plants are usually plentiful. When big, nutritious paloverde seeds drop to the ground, the kangaroo rats and pocket mice concentrate almost entirely on collecting them, using little fur-lined pouches in their cheeks as built-in shopping bags during their seed-gathering frenzy. The season's entire crop of foothills paloverde seeds falls within a few weeks' time before

the summer rains begin. Each night, the rodents are able to eat only a very small fraction of the many seeds they manage to collect; the rest are buried underground in caches for possible future recovery. The rodents use a keen sense of smell to later relocate, dig up, and eat their buried caches.

So many seeds are buried by the rodents, however, that many are never found. Those that escape discovery have a chance to germinate and eventually develop into new paloverde trees. In a sense, kangaroo rats and pocket mice inadvertently serve as wee desert gardeners. Looking out over a Sonoran Desert landscape, any one of the full-sized paloverde trees you see may well have begun its life as a seed taking a wild, midnight ride through the desert in the cheekpouch of a pocket mouse. Buried perhaps more than a century ago in the desert soil, but never retrieved, it germinated and grew, producing more seeds to feed hundreds of successive generations of seed-eating rodents.

However, being a wee desert gardener is very dangerous, because so many predators find kangaroo rats and pocket mice so tasty. Like the rodents, most of

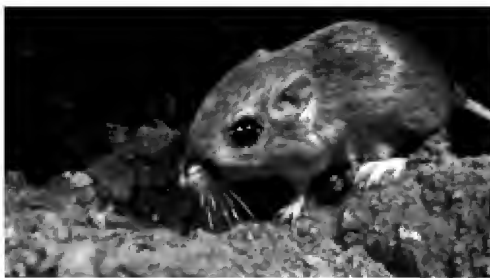


Monsoon thunderstorm in the Sonoran Desert.

**Embodied silence,
velvet soft, the
owl slips through
the night.**

**With Wisdom's
eyes, Athena's bird
turns darkness
into light.**

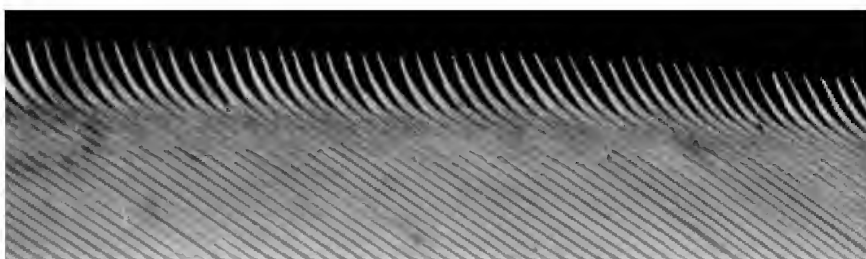
— Joel Peters,
"The Birds of Wisdom"



Merriam's kangaroo rat—one of the "wee desert gardeners."



Cluster of four paloverde seedlings emerging from a rodent's cache of buried seeds.



Comb-like leading edges of an owl's primary wing feathers enable the bird to fly silently.

these predators take refuge from the heat of midday, and then come out at night to seek their prey. The foraging behavior of the seed-eating rodents is affected by their nighttime pursuers, too. Many studies have shown that rodents are much less active on moonlit nights, perhaps to avoid visual detection by predators.

Among the most efficient nocturnal mouse hunters occupying the grounds of the Desert Botanical Garden is a resident population of western screech-owls. On bright moonlit nights, these small owls perch higher up in trees than usual, presumably to better scan the surroundings for their moving prey. Once they have a fix on their prey, these eight-inch-tall predatory gnomes fly silently in for the kill, like miniature stealth aircraft. The forward edge of the first flight feather on each wing is serrated rather than smooth, which muffles the sound of air rushing over the wing during flight, giving them a stealthy advantage when hunting.

The large, forward-facing eyes that give owls such an endearing look actually evolved to make them into efficient

little killing machines. Some species of owls have eyes that are up to six times better at light-gathering than those of humans. In fact, the size of the eyes relative to a screech-owl's body weight is greater than the total relative weight of the brain in an adult human. Their eyes are so large that they are immobile in their sockets; however, their flexible necks allow them to turn their heads to peer directly over their backs as they keep watch for predators larger than themselves. The little screech-owl is not at the top of the food chain here at the Garden and must literally "watch its back" for the almost two-foot-tall great horned owl that, if given the chance, will capture and feed a screech-owl to its own hungry young.

No other kind of bird exceeds owls in their ability to see in dimly lit conditions or to pinpoint the source of sounds with such deadly accuracy. The heads of owls are little more than brains, beaks, and super-sized eyes and ears.

In addition to their use of sight and stealth, the owls also listen for their prey. The expression "I'm all ears"



Western screech-owl.



Summer Flashlight Tours

Flashlight tours are a sensory adventure where you will see, hear and feel the desert night with its nighthawks, snakes, insects and night-blooming flowers.

Flashlight tours are recommended for families and children of all ages and are also a perfect summer date.

**For additional information call
480-941-1225 or visit dbg.org
Thursdays and Saturdays
May - August / 7 p.m.**

takes on special meaning when it comes to owls—many species of owls have external ears positioned at different levels on either side of the skull. The feathers surrounding the eyes form a large facial disk that apparently serves as a sound amplifier to focus sound on the ear openings. By lowering its head until the sound of the scurrying mouse is equally loud in both ears, the owl can determine when the mouse is in line with its eyes. The “horns” or “ears” on the tops of many owls’ heads are not ears at all, but rather are actually erect feathers that may act as camouflage by giving the head the appearance of the end of a broken vertical branch. They may also serve as visual signals to potential mates or adversaries.

After a successful night of hunting and avoiding its own predators, most screech-owls in the Sonoran Desert seek safety and natural coolness by roosting in the cavities of saguaros. Studies have shown that they prefer to nest in

the larger cavities, which are excavated by the Garden’s biggest woodpecker, the ant-eating gilded flicker, and can accommodate their usual brood of three or four owlets. The moisture in the thick walls of the saguaro keeps the temperatures in the cavity cooler in the summer and warmer in the winter for most of the day.

This natural drama of life in the desert continues night after summer night at the Garden. Join us on a summer flashlight tour to watch these and other fascinating stories of nature unfold.

References

Hardy, P.C. and M. L. Morrison. 2003. Nest-site selection by western screech-owls in the Sonoran Desert, Arizona. *Western North American Naturalist* 63:533-537.

McAuliffe, J.R. 1990. Paloverdes, pocket mice and bruchid beetles: interrelationships of seeds, dispersers, and seed predators. *Southwestern Naturalist* 35:329-337.



The Garden Welcomes a

Prior to the winter holidays, the Hormel Family contacted the Garden about a boojum donation. Construction was scheduled to begin on the family's property, which would impact a magnificent plant. Gladly accepting the contribution, the Garden worked out a plan with Native Resources International to salvage and box the plant before the holidays and then move it in early 2010. In February the salvage company was able to make its move and bring the stately boojum tree to its new home.

What an operation that was! The day before the move, the salvage company laid the box onto the bed of a tractor/trailer rig. The following day, February 19, 2010, they brought the plant to the Desert Botanical Garden. They had already staged their equipment here and dug the hole, so everything was ready to go.

To prepare the space in Ottosen Entry Garden, Garden staff had to prune some trees and remove several plants located in the path of the equipment. Native Resources boxed a small tree that was also in the way of progress. They filled that hole with the soil dug out from the boojum planting hole. After digging the planting hole, they then created a ramp down into the hole so the machinery could be driven right down in.

Moving the plant from the trailer bed into the bucket of a front-end loader was quite a feat and amazing to watch. The boojum was so heavy that the tires were flattened on the machine. They also had a second loader chained to the first for ballast, and thus they slowly drove to the planting area with the two loaders chained together. After planting the boojum, they popped the other tree that was quick-boxed back into the ground, raked everything out and voilà, you would never know anything happened.

Native Resources estimated the boojum weighed 30,000 pounds, including box and soil. The plant is multi-stemmed and about thirty feet tall. They oriented the plant to face the same direction that it did prior to the move, so as to maintain the same sun exposure.

To view the boojum being moved into place go to [DBGVision at youtube.com](http://DBGVision.at.youtube.com) or type in your browser <http://tiny.cc/boojum>.

The Desert Botanical Garden expresses warm thanks to the Hormel Family for this wonderful gift to the community! We invite you to see the plant, located at the junction of Ottosen Entry Garden and the Desert Discovery Trail.

by Cathy Babcock, Director of Horticulture



AT ISLAND YOUR DESERT GARDEN

Support Tubers

As the summer arrives, many desert plants start to retreat, either by dropping leaves or returning to subterranean depths to escape the heat. These are just a couple of the strategies arid land plants employ to cope with our desert environs. In contrast, there are some desert plants that use an underground coping mechanism that allows them to actively grow during the summer months.

Tubers and specialized roots beneath the soil surface provide a way for many plants to store food and water. What is a tuber, and how is it different from a tuber-like root structure? A tuber, such as a potato, is actually an enlarged underground stem capable of storing water and food. In contrast, some desert plants have enlarged roots that serve as storage organs. These enlarged, thickened underground plant parts allow plants to endure the blazing hot summer as well as periods of drought by storing water.

A plant commonly found during the summer months is sacred datura, *Datura wrightii*, which has a tuber-like root structure. Sacred datura has large, deep green leaves, and incredible white flowers. It can grow to four feet tall and five feet wide. During the day, the flowers are wrapped tightly and will slowly unfurl as the sun bids its nightly farewell. Hawk moths will visit the fragrant flowers during the evening. Although each flower lasts for only one night, there are always more to follow during the subsequent evenings. Sacred datura prefers full to

By Angelica Elliott, Curator of Wildflowers



Clockwise from top left: *Amoreuxia palmatifida*, *Ipomoea lindheimeri*, *Datura wrightii* (immature fruit), *Datura wrightii*.

filtered sunlight and needs well-draining soil to look its best. At times, the plant may wilt during midday, but this does not always indicate that it needs water. It usually recovers by early the next morning. If it is still wilted by mid-morning watering may be necessary. By late fall, one may notice large worm-like creatures munching on the leaves. Don't be alarmed as it is likely the hornworm caterpillar, which will become the moth that pollinates the sacred datura. Keep in mind that the plant can be dormant during the winter months and all parts are poisonous if ingested.

A member of the cucumber family, slimlobe globeberry, *Ibervillea tenuisecta*, is a delicate vine developing from an underground tuber. It bears small yellow flowers on separate male and female plants (dioecious) during mid to late summer. The female plant will bear bright red, juicy fruits that can remain on the dried stems as it goes dormant during winter. *Ibervillea tenuisecta* can be planted in the landscape or grown in containers as long as the exposed tuber is shaded. If planted in the ground, it is best grown underneath one of our desert shrubs, like jojoba or creosote,

which will provide some shade and allow the vine to climb upwards. If growing in a container, make sure the soil has adequate drainage because the tuber can easily rot if the soil is too moist. Slimlobe globeberry is highly prized by many succulent plant enthusiasts, as the tuber can be elegantly exposed and artfully arranged in containers and sometimes can get as big as a foot long!

Another member of the cucumber family is buffalo gourd, *Cucurbita foetidissima*. The large, spreading vine has triangular-shaped leaves that are rough to the touch and have a rank odor when crushed. The flowers are bright yellow and are pollinated by squash and gourd bees during the early mornings. Following pollination, a green fruit with cream-colored stripes will form, which when ripe, will turn a straw color. Buffalo gourd prefers full sun and well-draining, organic soil much like its relatives, the melon, pumpkin, and cucumber. Start seeds in late spring through summer, soaking them overnight for better germination; transplant seedlings into a large, deep container to allow the tuber-like root to form. Buffalo gourd does not like to be kept in a



Clockwise from top left: *Cucurbita foetidissima* fruit, *Cucurbita foetidissima*. *Ibervillea tenuisecta* (immature fruit), *Ibervillea tenuisecta* (mature fruit).

container for too long, as this limits the growth and increases the potential for rot.

An exciting plant found in nurseries specializing in native plants is Mexican yellowshow or saiya, *Amoreuxia palmatifida*. In late spring, stems will arise from the tuberous rootstock and, depending on adequate moisture conditions, a cluster of flowers will appear. Flowers are bright orange with elliptical red marks at the base of the petals, and will open for a short time during the early morning hours. Little is known about the outdoor culture requirements, so the Desert Botanical Garden staff has planted saiya in the *Harriet K. Maxwell Wildflower Trail* and the *Steele Herb Garden* to test how it does in various garden conditions. At the moment, saiya appears to be a promising landscape plant for the Phoenix area. It tolerates the heat provided deep watering is given at least once a week during the initial establishment period and very little or no water during its dormant period in the winter months. It needs well-draining soil and seems to do well in soil that has been amended with compost. Plant saiya in an east-facing location, or in

an area that provides filtered light. Saiya can be grown and kept in containers with a 2:1 ratio of perlite to Supersoil mix. It is also important to lightly fertilize container grown plants during the active growing period to keep them healthy. Water at least once or twice weekly when grown in containers, but keep dry during the winter months.

Other plants with enlarged, thickened underground tissue are *Mirabilis* spp., *Merremia aurea*, *Callirhoe involucrata*, and *Ipomoea lindheimeri*, which can also be used in the landscape to add color, texture, and even fragrance. All of the desert plants listed will become dormant during the winter months, with the foliage dying to the ground, so it is advisable to mix with other evergreen plants to add interest year round.

Make sure to pick up a variety of these special tubers at the Fall Plant Sale. Check dbg.org over the summer for information and details.



join the CONVERSATION

Every season, every day, and every step reveals the ongoing story of life and beauty at the Desert Botanical Garden. I feel fortunate to have moments during my day to witness amazing growth and blooms, watch the round-tailed ground squirrels emerge from their burrows in the spring, or see the construction, planting, and debut of a new exhibit. Until recently, these were my private moments, but now, through social media, I am able to share it all with you. The following paragraphs will tell you about the websites on which the Garden is currently active.

by John Sallot, Director of Marketing



Facebook is a social media site that connects the user with other people, businesses, or ideas. The Garden's Facebook page currently has nearly 3,250 fans. Recent postings include photos of a screech-owl resting in an ironwood tree, a video of Chad Davis, curator of agaves and aloes, talking about the *Yucca faxoniana* blooming in the *Berlin Agave Yucca Forest*, and information from Wendy Hodgson's recent rafting trip in the Grand Canyon, where she helped the National Park Service and the Hualapai Nation assess future camping sites. In addition, fans of the Garden post their own pictures, ask questions, and talk to each other.

YouTube is a video sharing site; you can find us by searching "DBGVision." In less than a year we have posted forty-one videos and have had more than 21,000 views. We use a simple Flip camera and make most of our videos while out and about in the Garden. For a while, the most popular videos were the Chihuly sculptures being de-installed, but a video filmed last summer, in which I try to fry an egg in the parking lot, has become something of a cult classic, even inspiring a sequel. Combined, the egg videos have been viewed more than 3,400 times. The idea of frying an egg on the pavement is a hook to get you to watch, but the content of the video is 100% Garden information. There are also videos about night-blooming cacti, the butterfly exhibit, *Luminaria*, and even a video of the new, giant boojum tree—see page 8—being placed in the Ottosen Entry Garden.

Twitter is a microblogging site where users post what is happening right now...using 140 typed characters or less. On Twitter, we have nearly 1,500 followers and use the posts to share information about the Garden, much like we do on Facebook – just with more economy of words. Often, we post links to information on the dbg.org website or on one of the other social media sites. Recently, Twitter was helpful to a guest at a *Spiked!* event. He had a question, "tweeted" it to us, and we were able to answer him in real time. He was at the event but we never saw or met him, we just communicated through Twitter.

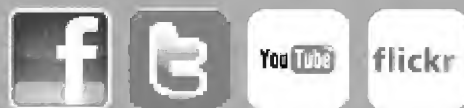
Flickr is a photo sharing site where we continually post new images from the Garden. When we began to use Flickr, we realized that there was already a Garden community that had formed in 2005 and includes 1,300 people. Rather than try to recreate it, we joined this community and post unique images almost daily.

In addition to social media, the Garden has developed the ability to deliver information via text messaging. Currently, we have more than 2,000 people who have signed up to hear about Garden activities in this way.

If you already subscribe to the *Garden News* e-newsletter, then you have noticed it change over the last year into a more robust vehicle for communication. *Garden News* e-newsletter is delivered to a subscriber's email box every other Monday (with an occasional Extra Edition) and contains information about events, exhibits, and classes at the Garden. We now have 46,000 subscribers. In the coming months we will be segmenting our email lists by different topics to ensure that our subscribers receive the information they want.

The Garden's adventure in social media has just begun, and we can't wait to see what new social media outlets our Garden members, friends, and fans adopt. We will do our best to be there to continue to bring you interesting content that will keep you connected to this special place. If you'd like to join the conversation, you can visit www.dbg.org and click on any of the social media icons on the home page.

To find us on social media visit www.dbg.org and click on any of the following icons:



To receive the *Garden News* e-newsletter visit dbg.org and click on "subscribe" on the Garden home page.

To receive text messages about Garden activities text "subscribe" to 411247.

Library Launches Online Catalog

You can now search the Schilling Library catalog online! Thanks to a gift from an anonymous donor in honor of Normandie Farm, the library now has an Internet-accessible catalog.

For two years, library volunteers and interns have been busy importing and augmenting new catalog records with information that is unique to our library materials. Particulars such as provenance, authors' signatures, and memorial and donor information have been added, which preserve the collection's history. Seventy-five percent of the 7,500 titles have been fully processed.

Librarian Beth Brand thanks volunteers Sylvia Yoder and Becky Uhl for their work and dedication to this project, which would not have been possible without their efforts.

To browse the library online, go to www.dbg.org/librarycatalog. Although materials do not circulate, we encourage you to visit and use the library's collection, a wonderful resource for exploring the fascinating world of deserts. Schilling Library is open from 12 to 4 p.m., Monday – Friday.



Welcome to Kimberlie McCue



The Garden is expanding the scope of its plant conservation program as Dr. Kimberlie McCue steps into the new position of Program Director, Conservation of Threatened Species and Habitats, with a wealth of conservation experience.

As a graduate student at the University of Missouri-Columbia she studied a rare California wildflower, *Clarkia springvillensis*, and played a role in gaining the plant's protection under the Endangered Species Act. During eight years as Conservation Biologist for the Missouri Botanical Garden

(MBG), Kim led efforts to conserve rare plants in a region spanning eight states. She has successfully partnered with multiple federal and state agencies and non-governmental organizations to achieve conservation goals. Kim also believes strongly in training the next generation of scientists and at MBG developed a strong conservation internship program for high school and undergraduate students. While Kim is no stranger to exotic locales, having worked in the field in North and Central America, and as far afield as the Republic of Georgia, the desert southwest presents a new and exciting landscape for her. Dr. McCue is looking forward to exploring and learning the flora of the desert, identifying key conservation issues, and collaborating with co-workers, volunteers, and groups beyond the Garden to protect and conserve the species and habitats of the desert.

Garden Club of America Announces Desert Studies Award

The Garden Club of America's Award in Desert Studies was established in 2006 to promote the study of horticulture, conservation, and design in arid landscapes. The award is a one-year scholarship for graduate or advanced undergraduate students studying horticulture, conservation, botany, environmental science, and landscape design relating to the arid landscape. The award is intended to have a wide scope pertaining to the arid environment, with preference given to projects that generate scientifically sound water and plant management.

We are pleased to announce that the winner this year is Eugenio Larios Cardenas, a Ph.D. candidate from the Department of Ecology and Evolutionary Biology at the University of Arizona. He is examining how seed size affects the survival and fecundity of plants and the way this trait evolves via natural selection. His proposal outlines a novel way to measure seed size after germination has occurred. His multiyear study will measure the effect of natural selection on the seed size of a desert annual plant in its natural habitat as a result of variability in the timing and amount of precipitation and competition.

Photo Credits

Page 2 Ken Schutzb, Sunset on Ottose Entry Garden – Adam Rodriguez
Page 3 Night-blooming cactus – Adam Rodriguez
Page 4 Elf Owl – Charlie Cobeon
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Page 6 Thunderstorm, paloverde seedlings – Joe McAuliffe

Page 6 Merriam's kangaroo rat – Ken Kingsley
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Page 14 *Schilling Library*, Kimberlie McCue – Adam Rodriguez
Page 15 Wedding couple – Keith Pitts Photography
Page 15 Botanical Illustration, *Mentzelia hualapaiensis* – Molly Gill
Page 15 *Stetsonia coryne* – Adam Rodriguez
Back cover: Garden scene – Adam Rodriguez

the Garden Wedding

NOTHING BLOOMS AS BEAUTIFULLY AS LOVE

10 • 10 • 10

Say "I Do!" with the Desert Botanical Garden! The Garden is hosting a dream wedding for a deserving Arizona couple with a strong connection to the Garden and the community. The winning couple, Cara Carboni and Brett Dusek will have a chance to celebrate their love and devotion with a spectacular wedding on Sunday, October 10, 2010.

With generous donations from 25 of the best local wedding vendors, this event will truly be a night to remember. The wedding will feature four of the Garden's venues to highlight the evening's events—ceremony, cocktail hour, reception, and after party. The entire Garden will be devoted to the happy couple and their friends and family—making every moment truly magical.

The Garden is partnering with *The Arizona Republic*, AZCentral, and KPNX Channel 12 so that the viewers and readers can share in the wedding planning experience. We are inviting all audience members to vote for their favorite wedding elements from April - October.

To help the winning couple begin their "Happily Ever After," visit dbgwedding.azcentral.com. Follow Cara and Brett's love story, take part in their special day, and fall in love with the Desert Botanical Garden all over again.



Cara and Brett

Garden to Exhibit Artists' Illustrations at Grand Canyon's Kolb Studio

July 2 – August 31, 2010

Known to many for its grand vistas and geological wonders, the Grand Canyon is also home to more plants than any other national park, and nearly half of Arizona's flora.

Garden staff has teamed up with Grand Canyon National Park and Grand Canyon Association to highlight the Canyon's diverse array of plants and their stories in an exhibit at the world-renowned Kolb Studio on the South Rim. The exhibit will showcase 40-50 pen-and-ink and color illustrations of the Canyon's rare and sensitive plants by Desert Botanical Garden Art and Illustration Program artists, under the guidance of Wendy Hodgson, DBG's curator of the herbarium, and Lori Makarick, vegetation program manager for Grand Canyon National Park. These illustrations will augment photographs and text highlighting the Canyon's plants, pollinators, life zones, habitats, role as an important plant refugia, history of botanical research, role of a botanist, challenges facing researchers and park resource managers, and why we should care. In addition, hands-on workshops and guided field trips that are geared toward families will be offered on illustration, and the plants and geology of the Canyon. Visit www.grandcanyon.org for more information.



City of Tempe Award

The Desert Botanical Garden has been selected to receive the City of Tempe's 2010 Group Volunteer Project Award, based on the work performed by the Desert Landscaper School in Tempe parks and habitat areas. The Garden was recognized for this honor at the Mayor and Council Annual Volunteer Recognition Reception on April 22, 2010, where the award was presented to Rebecca Senior by Tempe Mayor Hugh Hallman.



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The Mission Statement of the Desert Botanical Garden

The Garden's commitment to the community is to advance excellence in education, research, exhibition, and conservation of desert plants of the world with emphasis on the Southwestern United States. We will ensure that the Garden is always a compelling attraction that brings to life the many wonders of the desert.

Register now for Desert Landscaper School 2010-11

For easy online registration, go to dbg.org/desertlandscaperschool or call 480-481-8161.

Be a part of our fourteenth year of training professionals and novices in the best practices of desert plant care. Spend one morning a week exploring the science, mysteries, tips, and tricks that help plants thrive in this challenging environment.

- Would you like to know how to create landscapes that require fewer resources, less maintenance, and are so beautiful that everyone else tries to copy them? Let us show you how.
- Would you like to have billions of tireless workers that don't require a penny of your precious funds? Let us teach you in the Soils and Fertilizer class how to employ beneficial fungi, bacteria, and nematodes.
- Did you know that fungi cause the majority of infectious diseases in plants? Learn to identify the many faces of fungi and how to keep the harmful ones out of your landscape.
- Did you know that pruning is wounding? In Pruning classes, study the best management practices of the International Society of Arboriculture. When Certified Desert Landscapers assess a tree, they are not mystified: they know how to prune for the health of the tree.



- When the solution to your irrigation system problem is going to cost too much . . . wouldn't you like to know if that truly IS the best solution? In Irrigation classes, learn how to create a system with the best value and how to maintain it.

If you answered "yes" to any of these questions, you are ready to join us in the interactive, hands-on training that is Desert Landscaper School, as taught by the curators and horticulturists of the world-class Desert Botanical Garden. You, too, may become an advocate for desert plants and their conservation as you gain knowledge and appreciation of them.

SONORAN QUARTERLY

FOR MEMBERS AND FRIENDS OF THE DESERT BOTANICAL GARDEN

PHOENIX, ARIZONA SEPTEMBER 2010, VOLUME 64, NO. 3





Our Garden, like many around the nation, is taking action now to protect threatened and endangered plant species. We are seed banking, preserving habitats, and rescuing plant populations that would otherwise be lost forever.

A Noah's Ark for Plants

I was pleased in July, when *The Arizona Republic* announced a week-long series on the plight of our state's endangered wildlife. My pleasure soon turned to disappointment, though, when I realized that the entire series would be devoted to animals only.

Please don't get me wrong. I am an environmentalist. I love all of nature. But the simple truth is that without plants there would be no other life on earth. Whenever we think and write about Arizona's endangered wildlife, I believe we need to do so holistically, embracing the essential role that plants play in the ecological health of our state.

If you agree with this perspective, I think you will especially appreciate this issue of the *Sonoran Quarterly*. There are feature stories written by our scientists who are on

the front lines of plant conservation research—both in the field and in the lab. You will also read about the vitally important work of the Center for Plant Conservation, which our staff helped establish more than 25 years ago.

You will learn how we, as a public garden, are altering the way in which we operate in order to conserve more and consume less.

Most prominent ecologists think that the environmental stresses that native plants and animals endure today are going to get worse before they get better. That's a sobering thought. On the positive side, our Garden, like many around the nation, is taking action now to protect threatened and endangered plant species. We are seed banking, preserving habitats, and rescuing plant populations that would otherwise be lost forever.



For many plant species, public gardens may be the last stop before extinction. We exist to give them safe harbor, even as we long for the day when the process of environmental degradation stops and then reverses. Thanks in part to present efforts, we will eventually reintroduce endangered species back into their natural environments, knowing that they will be able to thrive on their own. That goal makes our work worthwhile.

Ken Schutz,
The Dr. William Huizingh
Executive Director

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In Appreciation

On our Cover

Once threatened by a mining operation, this
salvaged specimen of Organ Pipe Cactus,
Stenocereus thurberi, now thrives along the
Sonoran Desert Nature Loop Trail.

Photo by Adam Rodriguez, adamsphoto@cox.net

Back Cover

Fall Plant Sale Festival - October 15-17, 2010

Loss of desert habitat and the plants therein was a motivating factor in the founding of the Garden back in 1939—today, anyone who has been in Arizona for even a short while has witnessed the loss of desert habitat to development and industry.





Organ Pipe Cactus Forest along the Sonoran Desert Nature Loop Trail.

Desert Botanical Garden

Champion of threatened and endangered cacti

Living in Phoenix, it's easy to take cacti for granted. They seem to be everywhere!

But, in reality, *Cactaceae*, the family in which all cacti are grouped, is regarded as one of the most highly threatened plant families in the world. Cacti tend to be slow-growing and highly vulnerable to disturbance in their early stages of development. Agriculture, urban development, overgrazing, mining, and illegal collecting all conspire to make life for many members of this amazing group of plants more and more tenuous. Added to these pressures is the threat of climate change, with yet unknown and unpredictable consequences for the American Southwest.

by Kimberlie McCue, Ph.D.,
Program Director, Conservation
of Threatened Species and
Habitats; Charlie Butterworth,
Ph.D., Research Botanist; and Raul
Puente-Martinez, Curator of Living
Collections

However, cacti have a friend in the Desert Botanical Garden, which has worked since its founding to protect and conserve this very special plant family.

Saving Plants from the Blade

Take a walk along the *Sonoran Desert Nature Trail Loop* and you will soon find yourself amidst a scene unique in central Arizona – an organ pipe cactus forest. Populations of organ pipe cacti (*Stenocereus thurberi*) in the wild occur mainly in the state of Sonora, Mexico, and southern Baja California. In Arizona, the plants can be found only in the more southern Pima and Pinal counties, with Organ Pipe National Monument being the best place to see them. The northern-most locality for this species is near Casa Grande. So, how did these cacti end up in our garden?

Here's the story...

Loss of desert habitat and the plants therein was a motivating factor in the founding of the Garden back in 1939—today, anyone who has been in Arizona for even a short while has witnessed the loss of desert habitat to development and industry. When land is cleared, the plant life that resided there is snuffed out. Luckily, Arizona law allows for wild plants to be salvaged from privately owned sites if activities there would result in the destruction of the plants. The Desert Botanical Garden has often played a role in these plant rescues. One of the Garden's initial salvage projects was led by our first director, George Lindsay. He spearheaded an effort to rescue some organ pipe cacti that were threatened by a mining operation in Ajo, Arizona. These were among the first cacti planted

in the newly established Garden. More recently, in 1980, the mining company Phelps Dodge purchased the New Cornelia Mine in Ajo with plans to expand the open pit, thereby imperiling many of the organ pipes in the area. Garden staff again went into action! Victor Gass, then Curator of Living Collections, assembled a team of horticulturists and headed south, determined to save as many of the plants as possible. Using shovels and muscle, the Garden crew dug up nineteen organ pipes, ranging in height from five to ten feet tall. The plants were loaded into a pickup truck and transported to the Garden where they were transplanted along the *Sonoran Desert Nature Trail Loop* (SDNT). Fourteen of these plants survive to this day. If you visit the SDNT and count the organ pipes, though, you will find more than fourteen. That's because

the plants rescued in 1980 are growing alongside the plants George Lindsay rescued way back in 1939.

Are you wondering why the species has not expanded farther north? Believe it or not, it's because it gets too cold! The organ pipe cactus is sensitive to frost, which does occur sometimes, even in Phoenix. Fortunately, the ones planted at the Garden are in a rocky hillslope location that absorbs heat during the day and release it slowly at night, allowing this continual survival here.

Sometimes the answer is in the genes

It's easy to tell the difference between a saguaro and a cholla, or a prickly pear from a barrel cactus. But, differentiating one type of prickly pear from another can sometimes be quite difficult. You may wonder if it is important to know whether two cacti that

look alike are actually different. The answer is that it can mean the difference between survival and extinction for some rare plants.

Garden Research Botanist Dr. Charlie Butterworth is working to untangle just such a conundrum surrounding the Pima pineapple cactus (*Coryphantha robustispina* subspecies *robustispina*), a small to medium sized plant native to central southern Arizona (south of Tucson), and adjacent areas of Sonora, Mexico. In the U.S., this taxon (group of unique organisms) is currently listed as Endangered under the Endangered Species Act (ESA). The taxon received this protective designation because its populations are experiencing significant declines (about 40%) because of multiple threats, the most significant being urbanization. However, there is some debate as to whether this cactus is truly unique. One of its closest relatives, the Scheer's beehive cactus (*C. robustispina* ssp. *scheeri*), which is native to Arizona, New Mexico, Texas, and adjacent regions of Mexico, is considered by some scientists to look too much like the Pima pineapple for the two to be considered as distinct taxa. If the Pima pineapple cactus was deemed not to be a unique entity, then members of *Coryphantha robustispina* ssp. *robustispina* would simply be lumped with Scheer's beehive cactus. This would eliminate the Pima pineapple cactus from protection under the ESA, thus making the Arizona populations south of Tucson more vulnerable to threats.



George Lindsay on a salvage expedition, 1939.



Organ Pipe Cactus rescue operation, 1980.

Two recent studies attempted to assess whether the Pima pineapple cactus is different enough from the Scheer's beehive to be considered unique. The conclusions of these studies were contradictory: Bob Schmalzel, a researcher for a private firm, found that data of the physical attributes of the Pima pineapple cactus and its relatives did not provide sufficient evidence for continued recognition of two unique subspecies. However, Marc Baker, an adjunct faculty member with Arizona State University, in a more thorough study of the anatomical attributes of the Pima pineapple and Scheer's beehive, was able to show statistically significant differences between the subspecies.

Dr. Butterworth is now working to try to resolve the dispute as to whether the Pima pineapple cactus is unique, and thus should continue receiving protection, or if it is actually part of the Scheer's beehive group, and so should be removed from protective status. Using a tool of genetic research known as DNA fingerprinting, Dr. Butterworth will try to establish the relationship of these two cacti. Essentially, by looking at the DNA of the plants he will be able to determine if they are so closely related as to be like siblings, or whether they are different enough to be considered something like cousins. The results are expected in 2011, and could make all the difference for the persistence of the Pima pineapple cactus.

Backstop Against Extinction

As another means of protecting our unique desert flora, in 1984 the Garden became one of the founding members of the Center for Plant Conservation (CPC), a network of botanical gardens that works to conserve and secure from extinction the imperiled native plants of the U.S. One of the strategies of the CPC is to build an *ex situ* collection (meaning "off-site" or "outside" of the natural habitat) of the rarest and most threatened of our native plants. At the Desert Botanical Garden, we maintain and continue to build our *ex situ* collection of rare cacti and other desert plants. As part of its CPC work, the Garden is collecting seeds and plants of more than twenty rare cactus species.

The intent of our conservation collection is to represent as fully as possible the genetic diversity of these species across their range. By caring for these rare species we are providing a backstop against their extinction. If a population of the species were to go extinct in the wild, we would still have material that represents that population. But, depositing seeds into our seed vault is not the end of the story. The ultimate goal is to be able to place species back out into the wild, which means learning as much about those species as possible. Samples of the seed collected are used to establish germination and propagation protocols. DNA that is extracted from seeds allows us to determine the amount of genetic diversity present in each population and the species as a whole, which is important information for restoration

projects. Additionally, we will soon undertake a project to determine if cactus seed are best stored at cool or at freezing temperatures, thus allowing us to keep our collected seed viable for longer periods of time.

The Long Run

In 1936, like-minded residents of Phoenix formed the Arizona Cactus and Native Flora Society, with the purpose of establishing

a botanical garden that would help protect and preserve the native desert and its flora. Their vision became reality in 1939 with the opening of the Desert Botanical Garden. Protecting and conserving cacti has been a major focal point of the Desert Botanical Garden since the beginning, and we will continue to champion the cause of these unique plants of the desert.



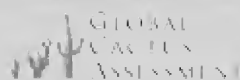
Cactus Assessment Team at the Desert Botanical Garden.

Garden hosts Global Cactus Assessment

by C. Butterworth, Ph.D., Research Botanist

The Desert Botanical Garden was proud to host the Global Cactus Assessment (GCA) workshop this past May. A total of ten cactus experts from the U.S. and Mexico attended, including the Garden's Raul Puente and Dr. Charles Butterworth, as well as Dr. Bárbara Goettsch, the program leader, and three other GCA/IUCN (International Union for the Conservation of Nature) facilitators. During the workshop, the experts and facilitators completed assessments of 128 species of cacti native to the Sonoran, Mojave, and Great Basin Desert regions. The work was intense and involved numerous discussions regarding species distributions, taxonomy, and conservation threats.

Preliminary results of the workshop indicate that about three quarters of the cactus species assessed are not under any considerable threat (good news!). However, the remainder are either currently under some form of threat, or could be in the near future.



This program was generously supported by the Cactus and Succulent Society of America



Garden Sustainability Program

by Brandi Eide, Conservation Collections Manager

The small group of individuals who created the Desert Botanical Garden in 1939 foresaw the need to conserve our beautiful desert environment.

Seventy-one years later, the need for conservation has not diminished, but rather is increasingly crucial and global in scope. The Garden has made great progress toward its sustainability goals in the past few years with the help of the Green Team, a committee of motivated Garden staff and volunteers. Many of these changes have happened behind the scenes where they may have gone unnoticed by our visitors and members, but have nevertheless made a positive impact. We have implemented the following changes and work toward further improvements in the future.

Energy Use

In 2007, the Garden became the second largest business customer participating in the Salt River Project (SRP) Energy Program. SRP donated and installed solar panels on the roof of Dorrance Hall, marking the beginning of the Garden's commitment to the use of renewable energy.

To further reduce energy usage, compact fluorescent lights (CFLs) and other lower-energy use, longer lasting bulbs are replacing spent bulbs. Motion sensing lights are being tested in one department, and will be implemented where feasible. All computer monitors in the Garden are Energy Star® compliant; when new computers are purchased, more efficient models are selected. Furthermore, we are continually evaluating

ways to consolidate the number of deliveries the Garden receives, thus reducing fuel consumption and associated pollution.

Water Use

Four waterless urinals, composed in part of soy resin, have been installed as older units needed replacing. In addition to being several hundred dollars less expensive, the units save more than 100,000 gallons of water per year.

Recycling/Waste

The Garden has greatly increased the volume and type of recyclables we capture. In 2008, the Facilities Department constructed twenty metal recycling/waste receptacles for placement around the Garden. Along with these bins, containers during events in the Garden and central recycling centers in each building have been added. We currently recycle #1 and #2 plastics, paper, cardboard, aluminum, steel, and glass. Additionally, some departments collect #3-#7 plastics, which staff members take home to recycle.

To further reduce waste, a receptacle near the exit collects used trail maps for re-use. We currently purchase 30% Post Consumer Waste (PCW) content printer paper (paper that has already been used and recycled), and default settings on copy machines are set for double-sided, black and white printing. We encourage staff to reduce or eliminate handouts at meetings, promoting the use of overheads or shared printouts when possible. Three of our print vendors use Forest Stewardship Council





The Garden has made great progress toward its sustainability goals in the past few years with the help of the Green Team, a committee of motivated Garden staff and volunteers.

(FSC) standards, and several suppliers use soy-based inks. Disposable water bottles have been replaced with a water dispenser at staff and volunteer meetings within the Garden, eliminating one-time use bottles from the recycling stream. Decreasing the number of disposable containers helps to reduce oil consumption in both their manufacture and transport.

At the Patio Café, Fabulous Food Fine Catering and Events uses compostable packaging for meals and group lunches. Catering companies are encouraged to be environmentally conscious through the use of reusable, recyclable, or environmentally friendly decomposable materials whenever possible. Also, the Garden no longer purchases products made of polystyrene foam (Styrofoam™). Throughout the Garden, all bath tissue and approximately half the paper towels are 100% PCW; we are working toward using 100% PCW for all towels used. Moreover, old or no longer working computers, monitors, and printers are broken down and separated into recyclable parts semi-annually.

Composting

The decomposition of organic material in landfills is a primary source of methane, a greenhouse gas more potent than carbon dioxide. That impact is lessened by diverting green waste into compost, as properly aerated compost does not produce methane. The Garden delivers green waste (tree and shrub trimmings) for composting to Singh Farms, removing approximately 180 tons per year from the landfill. This compost, along with compost tea, is then purchased for use in the Garden, thus closing the loop between waste and product. This not only preserves landfill space, but the subsequent use of the compost also aids in soil moisture retention and fertility, thus lowering the amount of water used and the need for synthetic fertilizer.

Air Quality

Volatile Organic Compounds (VOCs) are found in many products, and are emitted as gases which negatively affect the environment and human health. All new paint purchases are no VOC or low VOC when possible, and concrete stain is soy based. Gas powered blowers have been replaced with electric models, reducing VOC emissions as well as unwanted noise.

Employee Trip Reduction

The Garden offers incentives for employees to reduce trips or use alternate modes of transportation. On average, 15% of our entire staff either carpool, use public transportation or bike to work.

Purchasing/Procurement

Lower-impact alternatives for many of the products we purchase are always considered and selected when feasible.

Education

Many educational offerings that promote sustainable practices serve the community with ongoing classes, workshops, onsite presentations, and children's camps. Visit dbg.org for information on Garden classes.

The Garden is continually striving to improve our policies and procedures, while reducing negative impacts on the environment. We are working to preserve the environment by minimizing consumption and waste while promoting sustainability through internal changes, research, and education. We each have the responsibility and the power to make impactful decisions on a daily basis, which can positively affect the natural world, our communities, and future generations.

Practical, Stackable, Backyard Compost Bin

by Joe McAuliffe, Ph.D.,
Director of Research

Our native desert soils contain very little organic matter; adding it is an essential part of gardening.

Compost made from plant materials provides a ready source. Rather than bagging those leaves and sending them to a landfill, use them to enrich the soil of your backyard vegetable or flower garden.

When I started my home garden in Tempe, Arizona, the soil had the color and consistency of an adobe brick! Now twenty years later, the upper ten inches of soil is a rich dark brown and with a soft consistency that allows plant roots to do their best. Everything that grows in my garden that does not find its way to the table ends up in a compost bin. I compost the fallen leaves from my backyard fig, peach, and apricot trees. The many bags of fallen leaves from mulberry, fig, and ash trees discarded by other residents in my neighborhood also find their way to my compost bins. Instead of treating these resources as garbage to dump in a landfill, I think of these organic resources as special “autumn gold.”

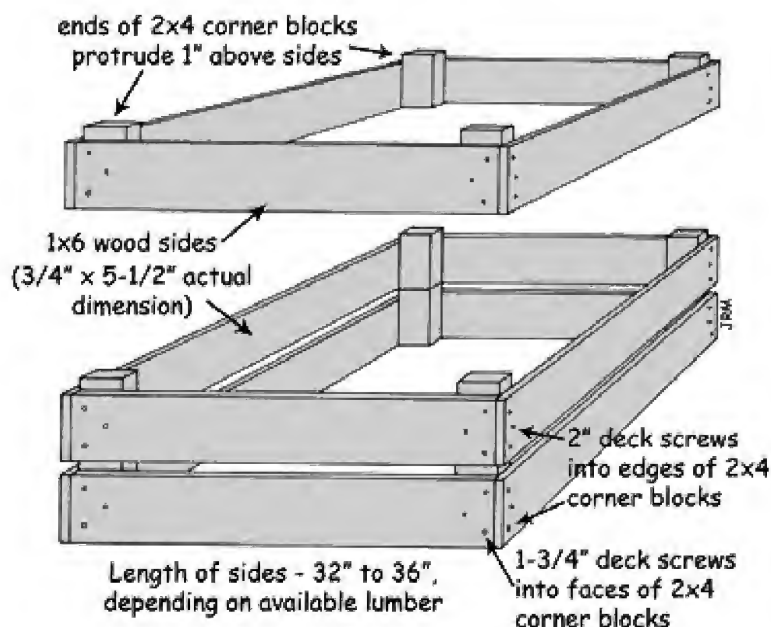
Making compost is not difficult and is easily accomplished in some kind of bin. The compost bins I designed and built are composed of stackable sections. This design is very practical because it facilitates the periodic turning of the composting materials, which aerates the pile and promotes decomposition. This turning needs to be done frequently, at

about weekly intervals during the early stages. A filled bin typically consists of six of these stacked sections. When I wish to turn the pile, I simply lift off the top section, place it next to the bin, and shovel the plant material into the section placed on the ground. A long-handled hay pitchfork with five long tines is the ideal tool for turning the pile. As I remove material, I continue to lift and unstack the sections and build up the adjacent, newly stacked bin. Presto! The contents of the bin are easily turned without ever having to reach down into the bottom of some deep, fixed-walled bin.

The sides of each section are 1x6 boards. Alternatively, 2x6 boards can also be used for two of the four sides, but this will yield a somewhat heavier section. These boards are joined and reinforced internally at the corners by short 2x4 blocks that are an inch longer than the widths of the side boards. The corner blocks are attached so they protrude one inch above the top edges of the sides. This short protruding post separates stacked sections with a one-inch-wide gap, allowing necessary aeration of the pile. Six stacked sections yield a compost bin slightly over three feet high, holding about a cubic yard of compost.

I made all of my compost bin sections from recycled, used scrap lumber. For example, redwood and Douglas fir 1x6s and 2x6s removed as part of a patio renovation project found useful second lives as a compost bin. Do not use any kind of plywood because the plies will separate in very little time, even if it is “exterior grade” plywood. If you cannot acquire any old, used lumber, an inexpensive alternative is 6-foot-long 1x6 boards of western cedar marketed at local home improvement centers as cedar fence boards. The price per board is around \$2.00 and two of these boards are required to construct one compost bin section.

I treat making compost for my garden as a special ritual, one in which I actively participate in enriching the earth. During the process of filling the bins and occasionally turning the developing compost, I revel in my role as the orchestrator of the organic alchemy that eventually will enrich my garden. In doing these simple things, my life is also enriched both materially and spiritually.



Sonoran Desert Adventure Program

Kids, Science, and More

by Tina Wilson, Director of Education

The Garden's Title I scholarship program provides funding each year for 10,000 students from qualified schools to take part in its educational programs and resources.

The Sonoran Desert Adventure Program is the Garden's field trip experience for Kindergarten through 8th grade students.

We have served more than 250,000 students since the program began in 2002. Field trips are designed and taught by Garden educators who blend the Garden's unique resources with hands-on, inquiry-based learning experiences, which help students get excited about nature and science. Garden field trips are specifically designed to complement school districts' educational objectives, and correlate with Arizona Academic Standards.

Field trips are scheduled October through May and are staffed with both paid and volunteer guides.

We offer nine themed investigations from which teachers can choose, based on their students' academic needs:

| | |
|--|--------------|
| Magic of Desert Plants | Kindergarten |
| Desert Buddies | 1st Grade |
| Desert Detectives | 2nd Grade |
| Secrets of Desert Plants | 3rd Grade |
| Plants and People of the Sonoran Desert | 4th Grade |
| Science of Survival | 5th Grade |
| Transpiration | 6th Grade |
| Key to Desert Plants | 7th Grade |
| Flower Power | 8th Grade |

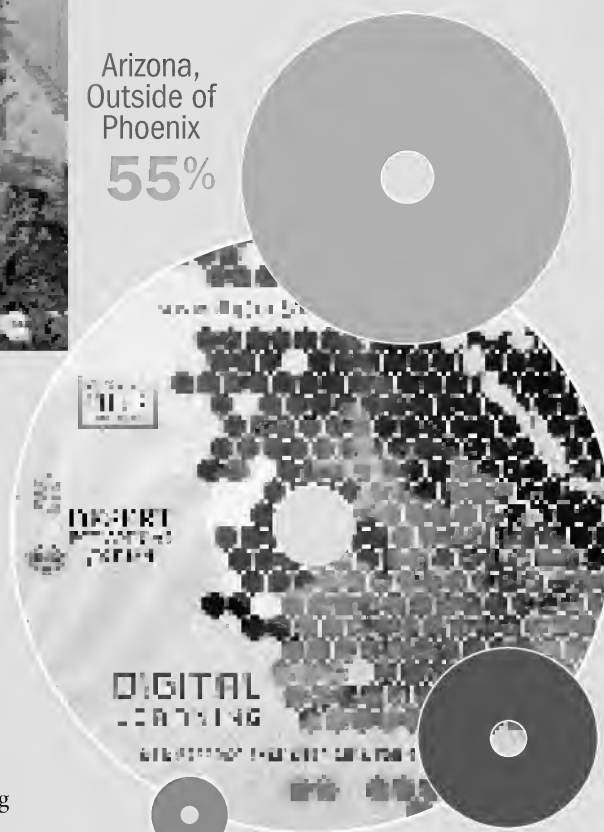




Distribution of Digital Learning Registered Users

Arizona,
Outside of
Phoenix

55%



Expanding Our Audience

Through the generous support of the *Tending the Garden* Campaign, we are able to extend these learning opportunities to a larger audience through two programs, Title I school scholarships and the addition of Digital Learning to the Garden's website.

The Garden's Title I scholarship program provides funding each year for 10,000 students from our qualified schools to take part in our educational programs and resources for free. Visiting the Garden benefits these students by stimulating their imaginations and broadening their horizons. So far, more than 30,000 Title I students have been served.

Digital Learning, generously supported by the Virginia G. Piper Charitable Trust, serves as an alternative form of educational outreach to students and educators unable to visit the Garden. It provides online resources and materials, which are aligned with the nine investigations of the Sonoran Desert Adventure Program that encourage outdoor exploration using their own schoolyards. Launched in September 2009, there are currently more than 250 registered users, with more requests coming in every day.

Science and More

During a field trip, there are many opportunities for students to enhance their learning experiences. In the Marshall Butterfly Pavilion, for instance, students can observe the interactions between butterflies and plants, as well as delighting in their natural beauty. This year, 15,684 students enjoyed this experience.

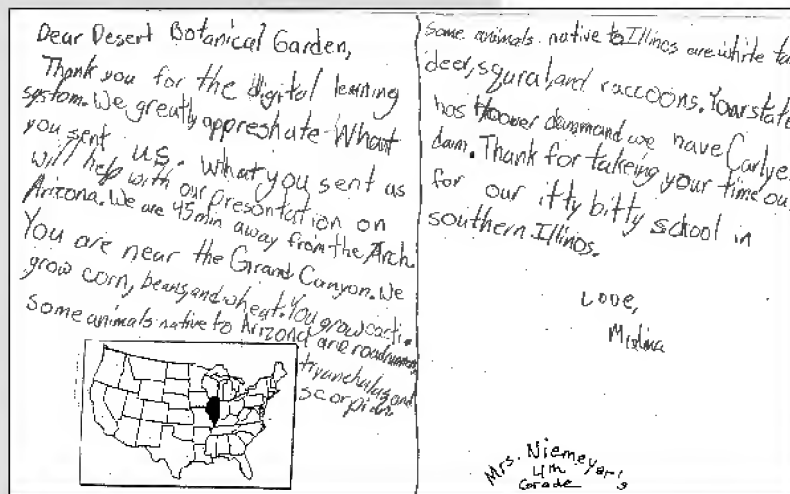
Last fall, 75 high school students in a Spanish language class augmented their tour by making offerings at the ofrendas during the Garden's *Día de los Muertos* Festival, in addition to exploring the Spanish Garden on the *Plants and People of the Sonoran Desert Loop Trail*.

As the tours stimulate investigative curiosity by combining art and culture with science, the result is a unique learning experience. It is a great example of science and art working together when students compare and contrast plant structures to Dale Chihuly's glass sculptures!

New for the School Year

A new program is launching this fall, which is geared toward the nearly 1,000 preschoolers visiting the Garden each year. The *Are You a Yucca* investigation will explore the three main plant parts—roots, stems, and leaves—while comparing these parts to their bodies. It takes place in the *Berlin Agave Yucca Forest*, where children will enjoy searching for clues or crawling through a life-size burrow in search of yucca roots.

As the Sonoran Desert Adventure Program evolves, we strive to make it a unique outdoor learning experience layered with fun and excitement.



6th Grade BLOG Comments

by Alejandro - 11/02/2009

I had a good time. The guides were pretty cool. They explained everything as good as possible. They answered all of our questions in a good way.

I liked the project we did, especially the cactus and the tree when we compared them. I liked everything especially the butterflies. So tell your staff to keep up the good work.

by Brianna - 11/02/2009

I liked the butterflies the most. My friend told me that one landed on my head and I just laughed!! I never knew that there was such a thing as a cactus with leaves... until I came here.

You can view more student comments at dbg.org/index.php/digital/students/journal/blogs

A SPECIAL THANKS TO OUR SONORAN DESERT ADVENTURE DONORS

This program is made possible in part by generous support from *The Arizona Republic*, Chase, SRP, Blue Cross Blue Shield, Cox Communications, Thunderbird Charities, The Kemper and Ethel Marley Foundation, The Dorrance Family Foundation, Herbert H. and Barbara C. Dow Foundation, The Fred Maytag Foundation and The Ferry Family Foundation in memory of Ernest S. and Virginia D. Ferry.





Tom Bekey has served as a volunteer and committee member at the Desert Botanical Garden since 2001, including former president of the *Volunteers in the Garden*. He moved to Phoenix from Seattle, Washington in 1994, when he retired from the position of vice president and principal geologist of the geotechnical engineering and environmental consulting firm of Rittenhouse-Zeman and Associates (RZA).



Dr. Laura Burgis is principal/owner of Burgis Envirolutions, a global green technology company. She is also founding director of the Center for Sustainable Solutions, a nonprofit center that will launch at Thunderbird Graduate School of Global Management this fall.



Craig Clifford, CPA, is a senior managing consultant with PFM Asset Management LLC, a firm specializing in providing treasury services for public agencies. He is a certified public accountant, certified government financial manager, and recently retired as the chief financial officer for the City of Scottsdale.

New Garden Trustees



Melodie Lewis is a long time resident of Arizona and a Garden volunteer. She previously served on the Garden's Board of Trustees, holding the office of president, and was active on many board committees, including the *Tending the Garden* Campaign cabinet that raised \$17.8 million for the Garden's endowment, exhibits, and programs. She is a Master Gardener, a member of the Columbine Garden Club, and also serves on the board of the Nature Conservancy.



Tammy McLeod is vice president and chief customer officer for Arizona Public Service Company (APS) and currently oversees Marketing, Customer Service, Corporate Communications, and Community Development. She also serves on the boards of Arizona Women's Education and Employment (AWEE), Greater Phoenix Economic Council, and Local First Arizona. In addition, McLeod is a gubernatorial appointee to the Arizona Humanities Council.



Paul Morell is vice president, Safety and Regulatory Compliance for US Airways. Prior to joining US Airways, he was a U.S. Navy pilot, reaching the rank of captain. Morell is currently serving on the Arizona Science Center Board of Trustees and as vice chairman of the Air Transport Association Safety Council. He was a pilot for 37 years previously serving as captain for US Airways Airbus A330, Boeing 757 and 767 fleets.



Barton Faber founded FABERcapital, a private equity investment firm, in 1998. Mr. Faber is also a partner in Atrium Capital in Palo Alto, California, which focuses on the information management and technology industries. In 1995, he served as chairman and CEO of Metromail Corporation, a NYSE listed database marketing company, where he oversaw the firm's IPO and actively directed their business strategy, operations, and growth plans.



Amy Flood is a Senior Vice President in the Real Estate Department at JP Morgan Chase. She has served on various committees at the Garden, including co-chair for Dinner on the Desert and Committee Chair for the Patrons Circle. She is active with Soroptimist International of Camelback, Inc., Xavier College Prep, St. Francis Parish, and is an instructor through Junior Achievement at St. Mary's High School.



Jeff Hebets, a Phoenix native, owns Metalmedia, a firm specializing in artistic metal creations for fun and function. His global awareness and humanitarian concern for others has led to his involvement in programs that truly make a difference. Hebets offers his enthusiasm, skill, and creativity to the Garden, along with his strong commitment to the environment.



Martha Hunter is a partner in Strategies, a marketing and communications firm. She serves on the board of the Sonoran Institute and previously served as president of its board of trustees, as chairman of the City of Phoenix Parks and Recreation Board, and on the boards of the Combined Metropolitan Phoenix Arts and Sciences, and the Phoenix Zoo. She is a member of Valley Leadership, and is past president of the Junior League of Phoenix.



Carolyn Polson O'Malley recently retired as executive director of the Dorrance Family Foundation, Scottsdale. Previously she was the executive director of the Desert Botanical Garden and public relations director of the Volunteer Center. O'Malley is currently on the boards of the Association of Small Foundations, Junior League of Phoenix Foundation, and is a trustee of the Papp Small & Mid - Cap Growth Fund.



Bruce Weber is president of the Weber Group, a marketing and consulting firm. Previously, he held executive positions with Microsoft in Washington, DC, and the Microsoft Partner organization in Redmond, Washington. Weber has served as a docent hosting Garden and Ambassador Tours and as a member of various board committees. He serves on the board of directors for Not My Kid, an organization dedicated to empowering youth, and of the Tesseract School, an independent school in Paradise Valley.



William F. Wilder is a senior member of the law firm of Ryley, Carlock & Applewhite. He previously served as a trustee, including board president, and is a member of various committees. He serves on the board of Audubon Arizona and has, over the years, served on and held leadership positions on the boards of a number of other civic, community based, and professional organizations.



Trustee Emerita:
Nancy Swanson, since moving to Arizona in 1980, has been active with the Desert Botanical Garden as a volunteer, docent, committee member, and Garden trustee. Through the Garden Club of America, she documented historical gardens of Arizona for the Smithsonian's Archives of American Gardens and, recently, as vice chairman, Scholarship, handled graduate scholarships in Desert Studies and student exchange opportunities with England, administered through the Royal Horticultural Society.

At Home in Your Desert Garden:

CARE OF YUCCAS

by Chad Davis, Curator of *Agavaceae*, *Aloaceae* and *Nolinaceae*

Yuccas are fascinating and fantastic plants: they have many ethnobotanical uses, are currently a hot topic for research on plant evolution, and can be stunning landscape plants. Why, then, are they so often overlooked when we are designing our landscapes? Many of the approximately fifty known species can thrive in the Southwest. Yuccas are drought tolerant, cold hardy, and require little maintenance. They come in a variety of shapes and sizes, have an array of foliage color, and produce beautiful eruptions of flowers each spring.

Yuccas are closely related to agaves; we can observe the similarity in the rosette leaf arrangement and large impressive bloom stalks. However, unlike agaves, yuccas don't die after blooming. In contrast to agaves, which are normally leaf-succulent, yuccas are considered semi-succulents, sometimes storing water in their trunks or root systems. Additionally, agaves generally have short trunks or stems, while yuccas range from stemless grass-like plants to massive, many-branched trees.

The native range of the genus *Yucca* is centered in Mexico and some species are found as far north as Canada and as far south as Central America. Although yuccas occur in very diverse habitats, difficult growing conditions are common to many of their natural environments. Yuccas often grow in areas with shallow, rocky soils. These hardy plants experience extreme



Berlin Agave Yucca Forest Exhibit.

annual fluctuations in temperature, often enduring both blazing heat and below-freezing chills. Because of their adaptations, yuccas are ideal candidates for Phoenix landscapes.

Yuccas can be incorporated into the landscape in many different ways. Planting tree-like species, such as *Yucca brevifolia* (Joshua trees), *Y. rigida*, *Y. filifera*, or *Y. faxoniana* can add height to the landscape, making a dramatic focal point that draws the eye. Shrubby species, such as *Y. baccata* (banana yucca) or *Y. thompsoniana* can add dimension and texture. Smaller species, including *Yucca pallida*, *Y. rupicola* and

Y. glauca, are ideal for planters and as decorative accents in even the smallest landscapes. Yucca species range in color from a dull olive green, to a deep shiny green, to various hues of blue, and some display highlights of gold or pink.

The installation of the *Berlin Agave Yucca Forest* last fall provided an opportunity to showcase some of the variability found within the genus, and produced a plethora of blooming yuccas throughout the past spring. Many of the plants displayed in the exhibit will be available for purchase at the upcoming Fall Plant Sale, October 15-17, 2010.



Yucca pallida



Yucca rostrata



Yucca faxoniana

Some ornamental yuccas to look for are:

Yucca pallida, a native of north-central Texas, is an exceptional pale-blue, clumping species that features many stemless rosettes. The margins of the leaves often glow a golden yellow color when backlit. These plants can be expected to reach about 2 feet tall and 3 feet wide at maturity. They develop rather quickly, generally blooming after just one or two years. The bloomstalks emerge as narrow panicles in late spring and grow to an average height of 4 to 6 feet, producing flowers right at eye level. *Y. pallida* can withstand

temperatures as low as -10°F, and will tolerate full sun or partial shade. It looks great as an accent, in masses and groupings, and would be a good choice as a potted plant.

Yucca rostrata, a native of the Chihuahuan Desert, is an outstanding yucca for landscaping in the Phoenix area. These plants are generally single-stemmed, and can reach up to 10 to 12 feet tall. The rosettes consist of hundreds of thin silver-blue leaves that form almost perfect spheres when mature. The bloomstalks are broad panicles that emerge in the late spring and last longer

than many other yucca species. *Y. rostrata* is recorded to withstand temperatures down to 5°F, and prefers full sun. They look great as single specimen plantings or in masses in more formal settings.

Yucca faxoniana, also native to the Chihuahuan Desert, is a superb yucca plant in the Valley. These massive plants reach heights up to 20 feet. Individuals usually remain as single stems until their first blooming event, when rosettes commonly split to form tree-like branches, or sometimes develop branches from their swollen bases. The dark yellow-green leaves of *Y. faxoniana* are among the largest in the genus at 3 inches wide and 4 feet long. The flowers are born on 4 to 5 feet tall bloomstalks, and are the truest color of white found in the genus. These are best used as specimen plantings; remember to give them plenty of room to grow.

In general, yuccas require slightly more frequent watering than most agaves or cacti, as they have less water-storing ability.

Caring for Yuccas

In general, yuccas require slightly more frequent watering than most agaves or cacti, as they have less water-storing ability. Watering is especially important during the first 2 to 3 years as the plants are establishing their root systems. During this time, regular water should be provided, particularly in warm seasons. Once established, yuccas will still need to be watered occasionally during long dry spells.

Frost is seldom an issue for most species, and most can tolerate or thrive in the full sun. Pruning is not necessary for growth and health; however, if branches impede walkways or get too close to structures, they can be pruned much like a tree, pruning at junctions with other branches wherever possible. Leaving the “skirt” of dried leaves on the plants is recommended, as they are a natural protection from extreme conditions. If you consider them undesirable or unsightly, these leaves can be cut near the trunk, leaving 3 to 6 inches of the leaf bases to protect the trunk of the plant. All pruning should be performed in the cooler parts of the year. When temperatures are low and plants are too wet, brown to black spots can appear on the leaves of many yuccas. Most of the time, this is a temporary condition, resulting from winter rainfall, so just remember to adjust your irrigation timers seasonally.

There are very few pests or diseases that affect yuccas. Although agave snout weevils, *Scyphophorus acupuncatus*, will occasionally infest and kill yuccas, they are not common. If a plant is found to be infested with weevils, it should be removed immediately. Mealy bugs and scale insects are sometimes found on the growing points of yuccas, but can generally be controlled by a few repeated blasts from the garden hose, or applications of insecticidal soap. Another common pest is *Caulotops barberi*, small insects that leave behind yellow to brown speckles on leaves. If caught in the early stages of infestation, this pest generally causes only cosmetic damage, however, if allowed to persist, the plant will ultimately die. Spider mites are a regular pest on non-desert yuccas. Control is achieved in the same manner recommended for mealy bugs and scale insects. To learn more about yuccas visit the *Berlin Agave Yucca Forest*.



Scyphophorus acupuncatus, better known as the agave snout weevil.

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2010/2011 Speaker Series



**Ocean Adventure:
An Evening with
Jean-Michel Cousteau**
Underwater Explorer
& Conservationist
**Wednesday
October 20, 2010
7:30 p.m.**

The son of the legendary Jacques Cousteau, Jean-Michel has carried on the family tradition of ocean exploration and advocacy.

An award-winning filmmaker, one of his documentaries helped persuade President George W. Bush to declare the Northwest Hawaiian Islands a Marine National Monument. Most recently, Jean-Michel has written *My Father, The Captain: My Life With Jacques Cousteau*. Hear his heartfelt tribute to a great pioneer of exploration and conservation, and discover how Jean-Michel Cousteau is carrying on his father's important work.

*All photographs by Carrie Vonderhaar,
Ocean Futures Society*



**America's Great
Wildlife Migrations**
Joel Sartore,
Photographer
**Wednesday
December 8, 2010
7:30 p.m.**

Best known for his photographs of wildlife, particularly endangered species, Joel Sartore wields his camera in the battle to conserve natural spaces and the habitats they support. This mission has taken him to some of the world's most remote and dangerous places, where he has risked serious illness and exposed himself to attacks by deadly animals in order to get images that bear testimony to the plight of our natural world. His entertaining presentation blend humor with powerful conservation messages and award-winning photography of wildlife and the places they inhabit.

Photo credit: Joel Sartore



**Exploring Mars:
The Next Generation**
Kobie Boykins,
NASA Engineer
**Wednesday
January 19, 2011
7:30 p.m.**

Kobie Boykins, a mechanical engineer at NASA's Jet Propulsion Laboratory, designed and helped build the celebrated solar arrays that powered the Mars Expedition Rovers in 2004. After completing their planned missions, the rovers did something amazing. They kept on going, capturing additional data and sending back images while working beyond their 90-day planned life. One is still roaming Mars today—more than five years later. Boykins' enthusiasm for space exploration and Mars in particular is infectious. Join him for an engaging evening exploring the Red Planet.

Photo credit: Courtesy NASA



My Wild Life
Mireya Mayor,
Primatologist and TV Host
**Wednesday
March 23, 2011
7:30 p.m.**

Often described in the media as "a female Indiana Jones," Mireya Mayor is not your typical scientist. Both as an primatologist working in the jungles of Madagascar, and as a wildlife correspondent for National Geographic, this city girl and former Miami Dolphins cheerleader has found herself in some unusual and exciting situations.

She is one of a handful of scientists researching the highly endangered lemur, and recently discovered a new species in the backcountry of Madagascar. She then persuaded the prime minister of Madagascar to establish a national park to help protect these rare creatures. Hear this inspiring scientist and explorer share highlights from her scientific and journalistic work, including behind-the-scenes stories from her most recent adventures.

Photo credit: Mark Thiessen

Garden members who use the code "desert" when ordering tickets will have 10% of their purchase price donated to the Garden.

Single Tickets begin at \$26 / 4-Part Series Subscriptions begin at \$94

Visit nglive.org and learn about other exciting events.

Ticketing information: 480-644-6500 / mesaartscenter.com
Mesa Arts Center – One East Main Street, Mesa, AZ

garden news

BioMythic Masks Exhibit

by Gwynn Popovac

The Desert Botanical Garden is pleased to announce a new exhibit, BioMythic Masks, by Gwynn Popovac. This dynamic show features eleven life-size masks that are representations of human faces blended with the shapes, textures, and hues of natural habitats – desert, tide pool, ice fields, or meadows.

Popovac describes her work as masks mimicking nature, and "...offer a vision of us as biomythic beings, spiritual animals aware of our essential and inextricable bond with the natural world." The masks are modeled and carved of plaster gauze upon armatures of wire. Their surfaces are embedded and embellished with a variety of fibers, stones, beads, braided threads, fragments of manmade objects, and found natural objects.

Gwynn Popovac was born in Delaware in 1948, but spent most of her childhood in the San Fernando Valley. Mainly self-taught, she did not go public with her art until she was living in Los Angeles, after attending UCLA as a literature student. In 1993, her insect portraits were published in a journal titled *Conversation with Bugs*. Her work with 3-dimensional masks began in 1990. Her work has been exhibited across the country. The exhibit, sponsored by a generous gift from Carol DuVal Whiteman, can be viewed in Ottosen Gallery from October 1, 2010 through January 2, 2011.



Garden's Executive Director Receives Award

The Garden's executive director, Ken Schutz, was among four Valley nonprofit leaders honored by The Organization for Nonprofit Executives (ONE) as "Director of the Year." Ken received the "Organizational Leadership Award," for his planning and execution of the *Chihuly: The Nature of Glass* exhibit.

las noches de las luminarias
DESSERT BOTANICAL GARDEN
presented by THE ARIZONA REPUBLIC

Members / December 2, 3, 4, 5
General Public / December 9, 10, 11, 12, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30
Member ticket sales begin October 11. Check our website at dbg.org for additional event information.

Photo Credits

Page 2 Ken Schutz – Adam Rodriguez
Page 2 Senita or "Old Man" cactus, *Pachycereus schottii*—member of the Cactaceae, one of the world's most imperiled plant families – Adam Rodriguez
Page 3 *Pleiospilos* sp. – Adam Rodriguez
Page 4 *Stenocereus thurberi*, Organ Pipe Cactus at the Garden – Adam Rodriguez

Page 5 Organ Pipe Cactus Forest at the Garden – Adam Rodriguez
Page 6 George Lindsay on a salvage expedition, 1939 – Courtesy Desert Botanical Garden Library
Page 6 Organ Pipe cactus rescue operation, 1980 – Courtesy Desert Botanical Garden Library
Page 7 Cactus Assessment Group – Charlie Butterworth
Page 9 Cans and bottles collected from one morning route-Friedman Recycling Co. – Brandi Eide

Page 10 Compost bin drawing – Joe McAuliffe
Page 12 School group at the Garden – Adam Rodriguez
Page 16 *Yucca rostrata* in the Berlin Agave Yucca Forest – Chad Davis
Page 17 Yucca and snout weevil photos – Chad Davis
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Page 23 *Stapelia gettleffii* – Adam Rodriguez
Back Cover Garden Plant Sale – Adam Rodriguez



The Desert Towers Invitational

The Garden is thrilled to report that as of June, 2010, the *Desert Towers Invitational* has received more than \$690,500 in commitments from more than 453 individuals who believe that the Dale Chihuly sculptures deserve a permanent home at the Desert Botanical Garden.

Special thanks go to GoDaddy.com for a spectacular \$100,000 gift. Appreciation goes

to longtime member Billie Jane Baguley, too, who first stepped forward with a remarkable gift of \$100,000 last October. We also want to acknowledge Jan and Tom Lewis for their \$25,000 Patrons Circle Challenge, as well as 21 other Patrons Circle members who have contributed \$33,350 in just the last three months.

Created specifically for display at the Garden's entrance in the agave spiral, the sculptures are a wonderful public art installation for the community. This \$800,000 effort is allowing us to both purchase the artwork and create an endowment for its ongoing maintenance. Join this exciting effort today!

For more information or to make a donation please call Lauren Svorinic at 480 481.8160 or visit dbg.org/chihulytowers.



Dinner on the Desert 2010

On April 24, the Desert Botanical Garden hosted a record 550 guests at Dinner on the Desert, the Garden's major annual fundraiser. This year's theme, Spirit of the Garden, celebrated Native American bronze sculptor Allan Houser and the Garden's commitment to bringing to life the many wonders of the desert.

The evening began with a silent auction of more than 250 items including specimen plants, containers, garden art, benches, fountains, and travel packages. The Super Silent Showcase featured exciting one-of-a-kind experiences such as a seven-day Polar Bear expedition for two and a ten-day Amazon voyage for two.

The Native American-inspired dinner by Santa Barbara Catering Company was served in Stardust Foundation Plaza while guests enjoyed the sounds of Burning Sky. The evening concluded with dancing under the stars on Boppart Courtyard with music provided by Big Nick and the Gila Monsters.

\$405,000 was raised, with proceeds from Dinner on the Desert supporting the Garden's mission of advancing excellence in education, research, exhibition, and conservation of desert plants. Dinner on the Desert has been held annually since 1986.

The Garden would like to thank Barbara Ottosen, the 2010 chair of Dinner on the Desert, as well as the Dinner on the Desert planning committee, Garden volunteers, and staff.

Pritzlaff Patio Renovations

Thanks to a gift from Mary Dell Pritzlaff, this summer the Garden's facilities department began renovations to Pritzlaff Patio. Retaining the original flagstone on the lower patio, steps and landing for historic Webster Auditorium, the improvements are focused on the hardscape patio which wraps around Webster Auditorium. Visitors will now see a safe and beautiful stained concrete surface, a decorative new railing, and low voltage lighting to enhance the space in the evenings. Soon, decorative containers featuring seasonal displays of floral and herbal plantings will be added.

The Garden Wedding: 10.10.10

Say "I Do!" with the Desert Botanical Garden! The Garden is hosting a dream wedding for a deserving Arizona couple with a strong connection to the Garden and the community. The winning couple, Cara Carboni and Brett Dusek, was chosen from more than 250 applicants and will have a chance to celebrate their love with a beautiful wedding on Sunday, October 10, 2010. Cara and Brett met on MySpace, while she was at home recovering from a bone tumor and while he was recovering from a near-fatal car accident. Together they talked, healed, fell in love, and have been together ever since.

Their touching story won them the wedding of their dreams, featuring generous donations from 25 of the best

local vendors. The wedding will take place in four of the Garden's beautiful venues: ceremony in the Wildflower Pavilion, cocktail hour in Stardust Foundation Plaza, dinner on Ullman Terrace, and dancing on Boppart Courtyard.

To share in the wedding planning experience, vote for your favorite wedding elements from now through October. The audience has already selected the Garden venues, fabulous wedding attire, upcoming voting options include the cake, flowers, hair, makeup and jewelry for the bridal party, and more.

To read more about Cara and Brett's love story and help them begin their life "happily ever after" visit dbg.wedding.azcentral.com.

in appreciation

The Desert Botanical Garden is grateful to all 25,246 members and donors for their support. Acknowledged in this section are annual Curator's Circle, Director's Circle, President's Circle and Founder's Circle members and donors giving \$2,500 or more over the year, from March 16, 2009 through June 15, 2010. Included are memberships, Desert Towers initiative and unrestricted gifts to support the Garden's annual operations.

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The Garden's commitment to the community is to advance excellence in education, research, exhibition, and conservation of desert plants of the world with emphasis on the Southwestern United States. We will ensure that the Garden is always a compelling attraction that brings to life the many wonders of the desert.



Fall Plant Sale Festival

October 15 – 17

Garden Members Preview: Friday / October 15
7 a.m. - 5 p.m.

Open to the General Public: Saturday / October 16
7 a.m. - 5 p.m. AND

Sunday / October 17 / 9 a.m. - 5 p.m.

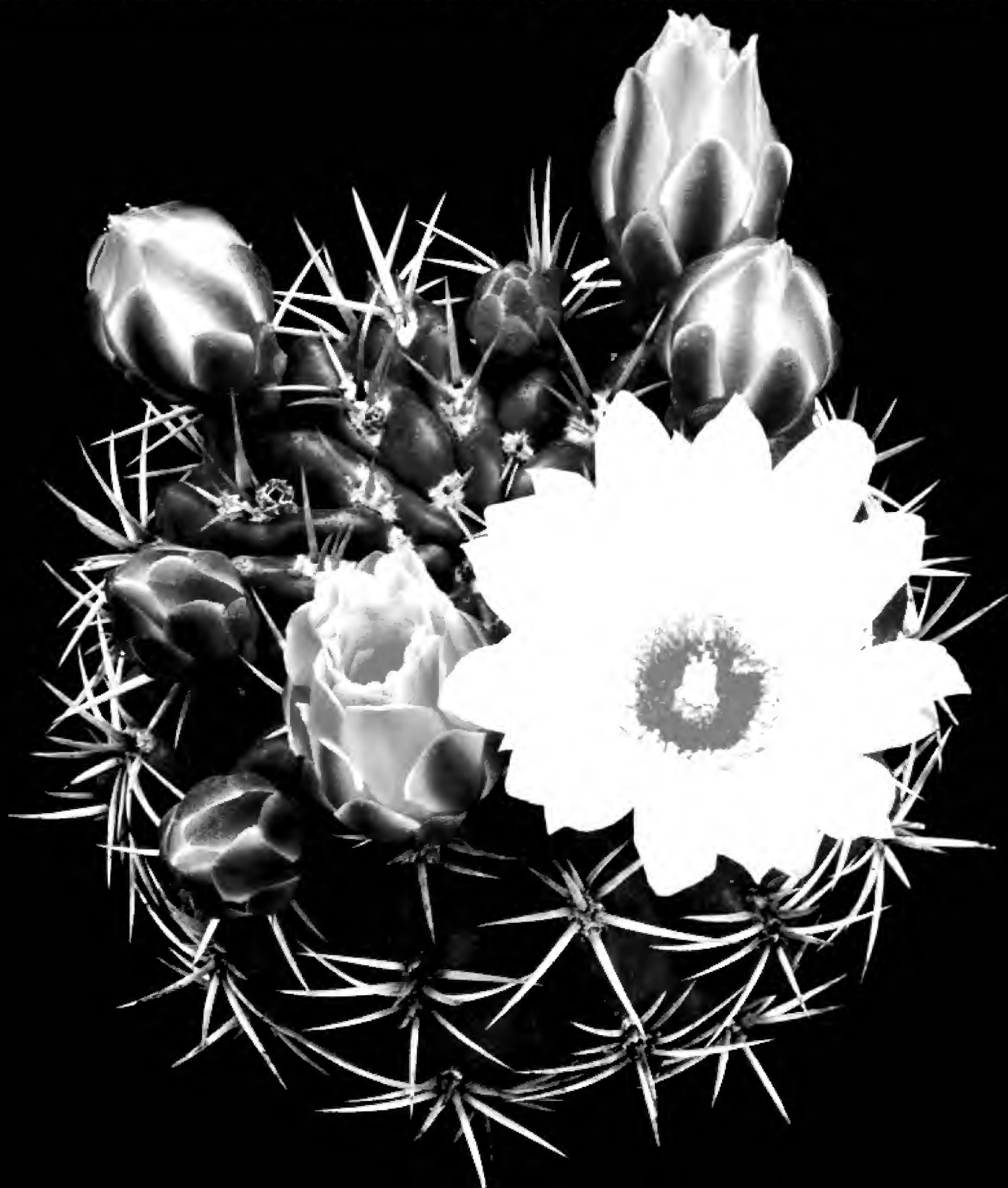
The Desert Botanical Garden Plant Sale Festival is a one-stop shopping experience featuring the largest variety of arid-adapted plants available in one location.

No admission charge to enter the Fall Plant Sale

Visit dbg.org for more information.

SONORAN QUARTERLY

FOR MEMBERS AND FRIENDS OF THE DESERT BOTANICAL GARDEN PHOENIX, ARIZONA DECEMBER 2010, VOLUME 64, NO. 4





Now is the time to create yet another five-year plan for the Garden, and in a new approach, I invite your participation.

The Power of Planning

It is not always glamorous, but it is essential: Planning, that is . . .

When I became Garden director almost ten years ago, I inherited a strong institution with a legacy of good planning. The directors who came before me had charted an exciting and ambitious course for our Garden. No example is more evident than the \$17 million capital campaign that was completed in 2001. Based on years of intensive research and planning, it yielded an entirely new campus of research and education buildings that propelled our Garden into the twenty-first century. My first few years at the Garden were spent guiding our operations as we grew into those spacious new facilities.

But soon my attention turned to creating a new five-year plan for the Garden; one of my most satisfying accomplishments

has been the creation of the comprehensive strategic plan that was adopted by the Garden's board in 2005. By now, the major goals laid out in a plan—including creating a \$10 million endowment, building new exhibit galleries, doubling our membership and attendance, and renewing our accreditation by the American Association of Museums have all been achieved.

Now it is time to create yet another five-year plan for the Garden, and, in a new approach, I invite your participation. In the article *An Eight-Step Process for Charting the Garden's Future*, that begins on page 9, I tell you more about the planning process currently underway and the major initiatives we are considering for the Garden in the period 2012–2017. I conclude by asking you to tell us what you want the Garden to be like in 2017,



what new initiatives you think are important, and which specific goals you would put at the top of the Garden's list of priorities.

I look forward to your input.

Ken Schutz,
The Dr. William Huizingh
Executive Director

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Sonoran Quarterly

December 2010, Volume 64, No. 4

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On our Cover

Gymnocalycium eurypleurum commonly called chin cactus is from South America. It is a summer grower needing partial shade. Water once a week in the summer and keep dry in winter. Photo courtesy of John Schaefer.

Back Cover

Las Noches de las Luminarias 2010

Make plans for the Valley's best holiday event where the Garden comes to life with more than 8,000 hand-lit luminaria bags.

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National Recognition of Cactus and Agave Collections

by Raul Puente, Curator of
Living Collections;
Chad Davis, Agavaceae
Collections Manager; and
Scott McMahon, Cactaceae
Collections Manager

In May of this year, the Garden once again lived up to its mission “...to advance excellence in education, research, exhibition, and conservation of desert plants...” when its living collections in the cactus and agave families were designated as the country’s National Collections of those two plant families. This prestigious recognition was granted by the North American Plant Collections Consortium (NAPCC), part of the American Public Gardens Association (APGA). Although the Garden’s holdings of these two families has long been known as

one of the world’s most impressive living collections, receipt of the official National Collections status adds validity to this claim.

What is the NAPCC?

The NAPCC is a network of botanical gardens and arboreta working to coordinate a continent-wide approach to the preservation of living plant material, and to promote high standards of plant collections management. All designated collections serve as reference collections for plant identification and cultivar registration and are also a source of documented materials for scientific



Sybil B. Harrington Cactus Gallery

The designation of our Cactaceae and Agavaceae collections as National Collections is a formal recognition of the Garden's long commitment to these plant families.

study. Currently, there are thirty-nine National Collections situated in more than seventy participating botanical gardens and arboreta. Some of the individual collections are found at single locations. For example, the National Collection of elm trees (genus *Ulmus*) is located at the Morton Arboretum in Illinois; the National Collection of citrus is at the Fullerton Arboretum on the California State University Fullerton campus. Other National Collections are multi-site collections distributed among several institutions. The National Collection of oaks (genus *Quercus*) is held by seventeen botanical gardens and

arboreta located throughout the United States. Information about plants in all of the National Collections is made available to participating institutions so they can compare holdings in order to identify duplications or gaps in their own collections. This collaborative sharing of information makes efficient use of available resources, strengthening all of the collections.

The Application

Garden staff began the application process in 2009, beginning with announcing our intention to propose the two collections for consideration as National Collections at the annual APGA conference in Boston. The application was completed and submitted to the APGA in February 2010. It included a printout of the plant database, which included the names and number of plants, where the plants were collected or obtained, and other collection data for each accession. (An accession is a single plant or group of plants that have common data, including collection locality and date.) More than 500 pages of information were included in the application for the cactus family (Cactaceae) and about 200 pages for the agave family (Agavaceae).

The NAPCC designated Michael Bostwick, Curator of Horticulture at the San Diego Zoo, to conduct the on-site review at the Desert Botanical Garden. In early April, he spent two days at the Garden examining the collections and interviewing staff. In addition to directly reviewing the horticulture program's care of the collections, he also assessed the way the collections are used and integrated into other Garden programs, including research, exhibits, and education. His review also included meetings with the Garden's executive director, the president of the board of trustees, and the directors of the



Engelmann's prickly pear - *Opuntia engelmannii*

research, education, horticulture, and exhibits departments. He then prepared two separate reports, with a total of twenty-four pages. On May 19, six weeks after his visit, we received notification from the NAPCC granting the national status to our Cactaceae and Agavaceae collections.

Significance of Designation as a National Collection

The designation of our Cactaceae and Agavaceae collections as National Collections is a formal recognition of the Garden's long commitment to these plant families. It also acknowledges past and present staff members who had the foresight to develop world-class collections through their acquisition efforts, horticultural care and propagation of these plants, and the maintenance of accurate accessions records. The large number of plants and species in our collections and their thorough documentation made the Garden's collections of the cactus and agave families ideal for inclusion as National Collections.

The Cactus Family Collections

The living collections of cacti have been a prime focus of the Garden since its beginning in 1939. It currently maintains more than 7,890 accessioned, living specimens of 1,319 species of cacti, representing almost three-quarters of all cactus species. Nearly 70% of those plants have associated data documenting collection locations in the wild, making those plants extremely valuable for educational purposes and scientific research. The quantity and quality of our collection makes this the most prominent cactus collection in the United States and perhaps in the world. The collection includes a vast array of different groups of cacti ranging from the prickly pears and their kin (subfamily Opuntioideae) to globular

Right: View of Arizona Agaves Collection along the Desert Discovery Trail

Below: Cardon - *Pachycereus pringlei*



Creeping Devil - *Stenocereus erua*

and columnar species of both North and South America. Some tropical and high-elevation species that require modified environments to protect them from the harsh summer climate of Phoenix are also represented. These unusual living plants are enjoyed by more than 320,000 visitors annually; visiting researchers from the United States and abroad, who request materials such as tissue samples, seeds, and pollen for scientific studies, enjoy seeing the spectacular variety of species as well.

Throughout its history, the Garden has been a valuable resource for scientific information about cacti. Some of the most up-to-date knowledge about the cactus family has been generated by our research staff. For example, the late Dr. Edward Anderson, Senior Research Botanist from 1991-2001, published *The Cactus Family*, a scientific synopsis of knowledge of all genera of cacti, during his tenure at the Garden. Currently, Research Botanist Dr. Charles Butterworth presses ahead with research on the evolution of cacti through studies of DNA. Other botanical gardens recognize our scientific expertise on cacti: recently, the New York Botanical Garden invited our researchers to write a comprehensive treatment of the cactus family for a series of botanical books entitled *Intermountain Flora*. The project, completed this year, was led by Herbarium Curator Wendy Hodgson, with contributions by Assistant Herbarium Curator Dr. Andrew Salywon, Dr. Butterworth, and



View of cacti and agaves along the Desert Discovery Trail

The quantity and quality of our collection makes this the most prominent cactus collection in the United States and perhaps in the world.

Garden research associates Drs. Marc Baker and Donald Pinkava. Access to the Garden's large and diverse living cactus collection, supported by our extensive herbarium collection of pressed and dried specimens, makes research efforts like these possible.

In addition to scientific contributions, Garden staff has also substantially expanded knowledge about the horticultural care of cacti. Techniques and guidelines for the moving and planting of large saguaros, for instance, have been shared widely.



Agave sp.

The Agave Family Collections

The Garden houses one of the most diverse collections of the Agavaceae (century plant family) in the world. Currently the collection contains over 340 species and varieties, and more than 2,500 plants.

The family includes nine genera: *Agave*, *Beschorneria*, *Furcraea*, *Hesperaloe*, *Hesperoyucca*, *Manfreda*, *Polianthes*, *Prochnyanthes*, and *Yucca*. All have cultural and economic importance both regionally and worldwide.

The genus *Agave*, for which the family is named, has been another priority of the Garden since its inception. The artistic depiction of an agave on our logo gives testimony to this focus. The Garden still holds plants collected by some of the most influential figures in its history, including past directors George Lindsay, W. Taylor Marshall, W. Hubert Earle and Rodney Engard. Dr. Howard Scott Gentry, author of the most important monograph on agaves, *The Agaves of Continental North America* published in 1982, introduced hundreds of specimens into the collection as he researched these fascinating plants. Research activities continue today as Garden scientists use the collection to generate new knowledge in the fields of systematic plant evolution, ecology, horticulture,

and conservation. Wendy Hodgson continues Dr. Gentry's research legacy through her current research on agaves, which has included discovery and naming of three new species and ways in which pre-Columbian inhabitants of the region used certain species.

Agave is only one of the many genera contained within the family Agavaceae. Living specimens of other genera, such as the genus *Yucca*, are some of the most impressive plants growing in the Garden. Tall Joshua trees (*Yucca brevifolia*) and other arborescent yuccas can be seen throughout the Garden. The bold forms, interesting textures, and striking colors of all the members of the agave family highlight, accentuate, and punctuate the trails and exhibits. Some wonderful examples can be viewed in and around the *Sybil B.*

Harrington Cactus & Succulent Galleries and the historical beds near Schilling Library. The recently installed *Berlin Agave Yucca Forest* showcases these fantastic plants. *The Plants and People of the Sonoran Desert Trail* is home to many native species that have played important roles in the historic and prehistoric lives of indigenous cultures.

Looking to the Future

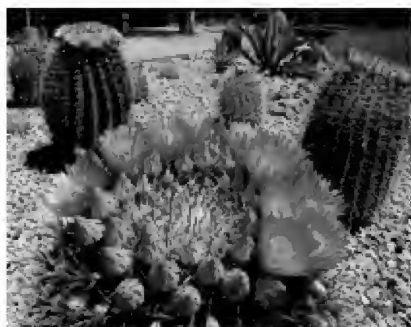
With the designation of our Cactaceae and Agavaceae families as National Collections, the Garden is officially recognized as possessing important, world-class collections. This honor is not an end in itself, however, even as it acknowledges our long-standing and on-going commitment to advance excellence. To that end, Garden staff are currently in the process of creating collections plans for both families, which will carefully examine the needs of multiple users and the degree to which the collections serve both those needs and its own mission. This plan will ultimately contribute to improvements in curation and record keeping, and will also yield priorities for future acquisition of new species of plants. As work goes on to ensure that its future collection will be grander than ever, the Desert Botanical Garden proudly accepts the honor of the two National Collection designations.

THE DESERT BOTANICAL GARDEN IN 2017

An Eight-Step Process for Charting the Garden's Future

by Ken Schutz, The Dr. William Huizingh Executive Director

As noted in my *Desert Journal* introduction, I think good planning is critical to the future health and success of the Garden. Our institution has a legacy of looking forward, setting ambitious goals, and then achieving them. For the period 2012–2017, I intend to follow the same planning process we have used in the past, with one major change. This time, through the power of technology, especially the Garden's new website, I invite you to take part in the planning process.



The process consists of multiple steps—described below, with the top ten preliminary initiatives identified in step six. After you have considered the initiatives, I ask you to go to the Garden's website—dbg.org—and click on the Member's Survey link. There, you can tell us what you think about the initiatives as well as about your own vision for the Garden in 2017. The final version of the Garden's strategic plan will be much stronger because of your participation; I thank you in advance for helping us do this important work.

Step One: **Mission**

The Desert Botanical Garden's commitment to the community is to advance excellence in education, research, exhibition, and conservation of desert plants of the world with emphasis on the Southwestern United States. We will ensure that the Garden is always a compelling attraction that brings to life the many wonders of the desert.

Every institution must embrace its mission, its very reason for being. The Garden's mission has changed little since it was first formulated. As articulated by our founder Gertrude Divine Webster in 1939, we are here to educate, conserve, exhibit, and conduct research about desert plants. In 2004, we expanded our mission slightly to emphasize our responsibility to serve our community, and to reaffirm our commitment to assuring that the Garden is always a dynamic place to visit.

We started the planning process for 2012–2017 by revisiting the mission, concluding that it still perfectly articulates why the Garden exists and how we strive to serve our community.



The Desert Botanical Garden's vision is to be the premier center in the world for the display, study, and understanding of desert plants and their environments.

Step Two: Values

Stewardship: To protect and preserve desert plants, animals, and habitats.

Interdependence: To respect the mutual destinies that link people, plants, and all of nature.

Authenticity: To reflect our unique natural heritage and cultural history within a public garden setting.

Accountability: To act ethically and responsibly as we serve our many communities.

In shaping policies and programs for any organization, it is important to discuss and agree upon those core values that guide both long-range decisions and everyday activities. In preparing to create our new strategic plan, a tireless committee of staff, volunteers, and trustees agreed upon these core values, which will serve as touchstones for evaluating what we do now, and what we choose to do in the future.



Step Three: Vision

The Desert Botanical Garden's vision is to be the premier center in the world for display, study and understanding of desert plants and their environments. The Garden strives to be an indispensable resource in the Southwestern United States for helping individuals learn about Sonoran Desert plants as well as desert plants of the world, so that they will conserve and protect the natural world for the benefit of future generations. Every element of the Garden will reflect excellence, beauty and inspiration to transform the visitor experience into one of discovery and meaning about deserts and desert plants.

The creation of a meaningful plan for the future requires articulating a vivid image of what is possible—a vision that inspires everyone to aim high, to believe in their own potential to achieve greatness, which, when achieved, will have boosted the Garden to a higher plane of excellence in all of its programs and services. The vision statement above was created and endorsed by the same committee of dedicated staff, volunteers, and trustees that developed the new values statement.

Step Four: Dreaming, Filtering, and Prioritizing

Given this vision for the Garden's future, I set out to meet with every department in the Garden, every group of volunteers, and every member of the board of trustees to ask one simple question: "What are your dreams for the Garden's future, especially in the context of the new vision we have articulated?"

This "from the ground up" approach to planning took more than a year, and yielded a forty-page list of ideas. The task of filtering through all those ideas to develop a concrete set of priorities fell to the board's strategic planning committee, capably chaired by Garden trustee Shelley Cohn. As a retired arts executive, a board member, a volunteer horticulture aide, a graduate of the Desert Landscaper School, and a self-proclaimed lover of all agave species, Shelley was uniquely qualified to lead this committee. Over the last year the committee met monthly to analyze all the suggestions that had been made and to create a preliminary "short list" of the most important initiatives to consider for the 2012–2017 plan.



Step Five: Guiding Principles

Reducing the original forty pages of ideas to a handful of key initiatives was made possible once the strategic planning committee had established a set of guiding principles for evaluating each idea. The ten principles are enumerated below. In order for an idea to advance to the committee's preliminary list of recommendations for the 2012–2017 strategic plan, it had to further one or more of these guiding principles.

1. To extol the beauty of desert plants in a public garden setting.
2. To offer education, entertainment, safety, and accessibility to all.
3. To make Arizona a better place to live, work, and play—and a more compelling destination for tourists.
4. To serve the scientific community by curating relevant collections of plants, books, and herbarium specimens.
5. To expand understanding and appreciation of nature through the scientific study of plants and their environments.
6. To protect and conserve desert habitats and biodiversity in North America.
7. To promote environmental sustainability by demonstrating and teaching best practices in desert plant horticulture.
8. To promote institutional sustainability by protecting our human and financial assets.
9. To provide formal and informal education programs, with emphasis on science literacy.
10. To explore and share the myriad relationships that exist among plants, people, nature, and the arts.





The creation of a meaningful plan for the future requires articulating a vivid image of what is possible—a vision that inspires everyone to aim high, to believe in their own potential to achieve greatness, which, when achieved, will have boosted the Garden to a higher plane of excellence in all of its programs and services.

Step Six: Preliminary Initiatives

At the conclusion of its year-long analysis, the strategic planning committee has selected the following initiatives, which it believes best build on the Garden's current strengths and also hold the potential for advancing the Garden to the next level of excellence in pursuit of its mission. These are preliminary recommendations, subject to full vetting by all the Garden's stakeholders. It is this list of ideas that I hope you will help us evaluate.

1. To design and build a new children's/family-oriented garden space.
2. To expand the Garden's scientific collection of plants.
3. To design and build a state-of-the-art horticultural center with adequate greenhouses, shade structures, and propagation areas.
4. To expand and improve the amenities the Garden offers its members and guests to include new parking spaces, new and enhanced restrooms, and a more efficient and streamlined box office.
5. To design and build a new insectarium and/or an enclosed hummingbird habitat.
6. To design and build new education facilities with state-of-the-art classrooms and teaching laboratories.
7. To develop a significant community garden initiative with a focus on urban sustainability and conservation.
8. To create and operate a Conservation Think Tank that brings together scientists and policymakers to discuss and address the major problems that our community faces related to conservation and sustainability.
9. To create a full-service restaurant for Garden guests and visitors, and to improve the "lunch window" currently operating at the Garden.
10. To create and implement a master plan for renovation of the Garden's historic core trail focused on a program of perennial renewal for that trail.

Visit dbg.org and click on the member's survey to tell us what you think about the initiatives above.

Step Seven: Stakeholder Participation and Evaluation

Over the next six months, these ten possible initiatives will be fully vetted with all the Garden's stakeholders, including you. We want to know what you think of each of these proposed initiatives, and how you would rank them in order of importance. We also want you to share your suggestions for additional initiatives that might be included in the 2012–2017 strategic plan.

To participate in the Garden's strategic planning process, please visit dbg.org and follow the on-screen instructions on the homepage. I promise this will take only a few minutes of your time, and that your ideas will be fully considered for integration into the eighth and final step of the process, which we call synthesis. Your participation will make the final strategic plan much stronger. (Please have your membership number ready when you take the survey, as we would like to receive only one response per member household.)

At the same time we are receiving your input, we will also launch a series of task forces to help us evaluate these potential initiatives from the standpoint of investment and expected return, compatibility with the Garden's mission and values, and the sequencing, staging, and integration of these possible new initiatives with the Garden's existing facilities, human resources, and operations.

Step Eight: Synthesis and Selection of the Final Initiatives

In the spring, after the input of all participating stakeholders has been received, the strategic planning committee will reconvene to evaluate each of the preliminary initiatives listed above in light of the new information and insights received. I expect that some initiatives listed above will receive robust support and be included in the final plan adopted for 2012–2017. Other initiatives, upon closer scrutiny, may not. And still other ideas, yet to be articulated, may well emerge from the vetting process as worthy of inclusion in the new plan.

Those are things that we will know this spring, after you and others have shared your ideas with us. I will provide on-going updates in future issues of the *Sonoran Quarterly* as the planning process moves forward.

On behalf of the entire Desert Botanical Garden strategic planning committee, I thank you in advance for your participation in the planning process and, just as importantly, for your on-going and sustained support of the Garden we all love so much.





A Desert Illuminated

John Schaefer Photography Exhibit

February 25 – May 21, 2011

Ottosen Gallery in Dorrance Hall

10 a.m. – 5 p.m. | Daily



Echinopsis hybrid

Forty elegant photographs by the remarkable Dr. John Schaefer will be on display this coming spring in Ottosen Gallery. Schaefer's close-up studies of cactus flowers are sure to inspire and awe the viewer. The exceptional photographs in this special exhibition, *A Desert Illuminated*, are wrapped in the visual and contextual embrace of a Renaissance-era illuminated manuscript that connects the human passion for science and art. By placing a sheet of black construction paper behind the cactus he was photographing, Schaefer was able to isolate the subject, intensifying the composition of the richly hued and delicate cactus flower.

Dr. Schaefer is a talented and prolific photographer, who, with Ansel Adams, founded the Center for Creative Photography in Tucson, Arizona. This in itself is an outstanding career accomplishment, but Schaefer, President Emeritus of University

by Elaine McGinn, Director of Planning and Exhibition



Opuntia phaeacantha - Brown-spined Prickly Pear



Gynnocalycium denudatum - Spider Cactus



Carnegiea gigantea - Saguaro Cactus

OWN YOUR OWN SCHAEFER PHOTOGRAPHS

The photographs in this exhibition are available for purchase at the Desert Botanical Garden. Additional photos by Schaefer, his book *A Desert Illuminated*, note cards, and giclee prints are also available for purchase in the Garden Gift Shop and at dbg.org.

Please be sure to look for the Garden's spring calendar and visit dbg.org for lecture and workshop dates by Dr. Schaefer.



Each set includes twelve note cards, one of each image, with twelve white envelopes. The note cards are blank inside and include the plant's common and scientific name on the back of the card.

of Arizona, is also a conservationist and avid bird watcher who founded The Nature Conservancy in Arizona. He is the author of three popular books on photographic techniques; additionally, his photographs have been featured in *Arizona Highways*, among other publications.

In the foreword to his book, *A Desert Illuminated*, Schaefer states that “a memorable photograph evokes the difference between looking and seeing, actions we often equate.” Viewers of these memorable photographs immediately understand his meaning and feel as if they are seeing a cactus flower for the first time. Pistils and stamens appear to be lit from within, exploding off the canvas with a gentle movement that is delicately choreographed by nature and attentively captured by the artist.

Special thanks to Carol DuVal Whiteman for her generous support in funding this outstanding exhibition.

At Home in Your Desert Garden: Cycads

DINOSAUR FOOD IN THE SONORAN DESERT

Article and photographs by Leo A. Martin, Past President, Central Arizona Cactus and Succulent Society



Leaves of genus *Cycas* tend to be softer and look more delicate than those of other cycads. In addition to the sago palm, good performers in the desert include *C. thourasii* from Madagascar, shown above.



Dioon spinulosum, a lowland rainforest plant from Veracruz, Mexico, grows well in a Sonoran Desert wash. Each leaf is about five feet long.

Your children can't have a pet dinosaur, of course, but in the Sonoran Desert we can grow the plants that dinosaurs ate—cycads. That is, cycads were present at the same time as the dinosaurs, so they may very well have been dinosaur food.

Fossils show that by 200 million years ago, cycad forests blanketed all land masses of the Earth, having evolved millions of years before flowering plants. Fewer than 300 species now survive in various tropical and subtropical climates, including the subtropical Sonoran Desert, where they thrive in the heat. We don't know what led to their decline, but botanists speculate that cycads could not compete once faster-maturing, flowering plants evolved. Many resemble small palms. The resemblance is superficial though, since palms are flowering plants and cycads bear cones, not flowers. They are also dioecious, having male and female reproductive parts on separate plants. The best-known cycads are the misnamed sago palm (*Cycas revoluta*) and the cardboard palm (*Zamia furfuracea*).

As landscape focal points, cycads represent an excellent choice. They are even more impressive in small groves, where their dramatic foliage demands attention. Leaves take on many colors, textures, and forms ranging from light blue to deep green; from stiff and spiny to soft and flexible; from long to short; from straight to strongly recurving; from upright to sprawling. Many have spiky leaves and look good with succulents. There is sure to be a species of cycad that will suit your landscape plan.

Growth and care of cycads

Cycads produce leaves once or twice per year in flushes, usually in mid-spring, and again when the summer heat breaks. Most species sprout additional stems from the base, forming fine clusters with time. In species with subterranean stems, leaves emerge directly from the soil, resembling ferns. As an added plus, cycads tend to grow very slowly, adding only one to four inches of stem height with each flush. Older plants may have stems six feet tall or more, with leaves spanning three to eight feet. They seldom outgrow their space or need pruning beyond removing old leaves.

Before selecting cycads, learn their growth requirements. They need more water than cacti or agaves but less than leafy shrubs. They should never be allowed to dry out completely. Some live in deserts, but these are usually near watercourses where their huge root systems spread widely as they absorb any available moisture. Once established in the ground, drip irrigate deeply once weekly during the summer. Monthly winter watering is usually sufficient, but extra water should be given during winter hot spells. Balanced fertilizer applied monthly during warm weather speeds their poky growth but is not necessary.

Since cycads tend to grow on slopes in the wild, perfect drainage is a must in captivity. Plant them where soil will not stay soggy, on an elevated mound if necessary. Use a very loose soil mix in containers so water pours right through without pooling. Containers should be considerably deeper than wide to

accommodate the large roots. Be aware, too, that cycads resent root disturbance when transplanting, so be very careful not to disturb the root ball or the plant may sulk a year or more before producing leaves. When placing plants in the ground, cut holes in the old container but do not remove it. The cycad will push roots through all of the holes, and will rip apart the container as the roots grow.

Before selecting cycads, learn their growth requirements.

They need more water than cacti or agaves but less than leafy shrubs. They should never be allowed to dry out completely. Some live in deserts, but these are usually near watercourses where their huge root systems spread widely as they absorb any available moisture.

Most cycads do well with a few hours of morning or early afternoon sun or in dappled sun like that found under a sparse desert tree. They also grow well in bright shade on a patio. Almost none will survive all-day Sonoran Desert sun. Not many are bothered by our desert frosts if growing under a tree or patio cover, or against the house. An overnight frost cloth blanket will prevent leaf damage.

They have few pests. Rabbits may bite through an emerging leaf but will quickly spit it out. All parts of all cycads are extremely poisonous if eaten; take this into consideration if you have children or plant-eating pets.

Some species to consider

Several palm-like genera grow well here: *Cycas* from Asia, *Dioon* from Mexico and Central America, and *Encephalartos* from Africa. All of these will grow faster and bigger in the ground than in containers. *Dioon edule* has decorated Phoenix gardens for many years; its rough brown trunks and stiff,

comb-like green leaves provide a good contrast between rustic and formal styles. It takes more sun than any of its relatives, but still prefers afternoon shade. *Dioon tomasellii* grows just over the border in Sonora, Mexico. *Encephalartos* species have stiff, often spiny leaves, with amazing leaf shapes and colors.

The Florida coontie, *Zamia floridana*, is the one species native to the USA. It is used extensively in landscaping there. Its starchy stems provided food for Native Americans, and later European settlers extracted arrowroot starch from it. It performs well here as a medium-height ground cover or small shrub in partly shaded beds or in containers. *Zamia vazquezii* has underground stems and gracefully arching leaves with bright green, soft, wedge-shaped leaflets. It performs equally well in shady beds and indoor or outdoor containers.

Conservation issues

Almost all cycads are severely threatened, especially as land is cleared for agriculture and building. The best land for coffee, corn, or cocoa, for instance, is where cycads grow. Some people cut down cycads for medicine. Poachers in helicopters have been known to rip enormous specimens out of mountain habitats for sale to avaricious and unscrupulous collectors. A dozen species in the last fifty years have become extinct, with many remaining species almost certain to follow. They will likely survive only as specimens in botanical gardens or greenhouses. For these reasons, it is important that gardeners buy only plants that have been legally propagated from seed or by division of garden plants, and not wild-collected. In that way, you may possibly contribute to their ultimate survival while still enjoying these magnificent plants in your own landscape.

MORE INFORMATION

The Cycads by Loran M. Whitelock, Timber Press, 2002.

The Cycad Society, www.cycad.org.



Flushing leaves may be orange, maroon, or tan until fully expanded. This is *Encephalartos arenarius*.



The powdery-blue-leaved, extremely spiny *Encephalartos horridus* develops its famous coloration better in Arizona than in any other part of the USA.



Zamia vazquezii makes an excellent Sonoran Desert substitute for a Boston fern. Leaflets appear delicate and papery but it tolerates neglect, low light, and low humidity.

garden news

A Garden Gift to the Community

For Valley residents and guests who may otherwise not have a chance to visit, the Desert Botanical Garden offers two special opportunities to explore its beauty and five themed trails at no charge.

Free Afternoons, launched in October 2009, are held the second Tuesday of every month from 1 – 8 p.m., and represent a gift to Valley residents from the Garden's board of trustees and donors. More than 10,000 individuals participated in the first year, and the Garden was especially happy to welcome groups from senior centers, home school groups, and other community organizations. The Garden is currently seeking a sponsor to ensure that this program is continued in 2011 and beyond.

Culture Pass, begun in October 2008, is a partnership between Phoenix metro area public libraries and 14 Valley cultural institutions. Culture Pass gives library users free admission for two to four people. To date, 150,000 Valley residents



have utilized this service, with 13,000 visiting the Garden in the program's first year. Culture Pass is generously sponsored by the Virginia G. Piper Charitable Trust, Macy's, ShowUp.com, CBS Outdoor, *The Arizona Republic*, and Clear Channel Radio.

The Garden is committed to offering Valley residents access and the opportunity to experience the wonders of the world's

deserts and to nurture appreciation, respect, and understanding of the Sonoran Desert we call home.

For more information, visit dbg.org/beforeyouvisit to learn about accessing free afternoons and visit theculturepass.com to learn about utilizing Culture Pass.



Museum Leadership Institute at the Getty

The Garden's deputy director, MaryLynn Mack, was one of twenty-eight emerging arts and culture leaders from around the world selected to participate in the Museum Leadership Institute.

The Museum Leadership Institute, the primary executive development opportunity of the Getty Leadership Institute, is an in-depth residential program designed both to enhance the leadership of experienced museum executives and to strengthen their institutions' capabilities. During

the three-week program, Mack studied strategic and values-based planning processes, financial and budget analysis, and innovation in leadership.

She was also the latest recipient of a Chanticleer Foundation Scholarship in Professional Development, which funded her participation in the program. The scholarship aims to enhance public gardens through staff development.

Mack describes her participation in the program as "one of the most enriching and fulfilling experiences I have ever had. The time spent with leaders from art museums, science centers, and academic institutions and the energy and ideas that flowed from sessions, conversations, and lectures will have a direct impact on my work at the Garden."

Botanic Gardens Unite for Conservation

In June of this year, Dr. Kimberlie McCue, Program Director, Conservation of Threatened Species and Habitats, attended the 4th Global Botanic Gardens Congress in Dublin, Ireland. McCue was among 400 delegates, representing 71 countries, who met to celebrate the work that botanical gardens have been doing to conserve biodiversity and to chart the future course of gardens as global leaders for conservation. During the weeklong congress, thirteen plenary addresses were made by individuals within the global conservation botanical garden community, with 136 talks given in total. The overall message from these talks was that we are at a critical time in history, with over a third of all plant species on the planet currently facing



serious threats or nearing the point of extinction. However, botanical gardens have a unique capacity and obligation to step forward and work to not merely slow but substantially halt the loss of plant diversity.

Activities at the congress were not all strictly work, however. The delegates were treated to a reception in the historic State Apartments of Dublin Castle, where they were toasted by officials of the Irish government.



Kolb Studio Hosts Exhibit

"Amazing, beautiful display." "Wonderful." "Awesome." "Loved it." "Educational, inspirational and beautiful." "Above and beyond expectations." These are just a few of the hundreds of comments from some of the 20,550 viewers of the exhibit, "Grand Canyon's Green Heart: The Unsung Legacy of Plants," a collaborative effort between the National Park Service,

Grand Canyon Association, and the Desert Botanical Garden that opened at the South Rim's Kolb Studio last summer. It focused on the Park's incredibly diverse plant communities, rare plants, the botanists who have and continue to study them, and efforts to protect the park's vegetation. The exhibit included fifty pen-and-ink and full-color illustrations of the canyon's rare plants, which were produced by volunteer artists with the Desert Botanical Garden. Interpretive text and large-scale photographs by Gary Ladd also helped tell these and many other stories of the canyon's plants. The last day for the exhibit was August 31, but it will reopen at Kolb on December 9, 2010, and run through February 2011.



Photo Credits

Page 2 Ken Schutz - Adam Rodriguez
 Page 2 Wildflowers, Ottosen Entry Garden terrace - Adam Rodriguez
 Page 3 Easter Lily Cactus, *Echinopsis* sp. - Adam Rodriguez
 Pages 4-15 Garden photographs - Adam Rodriguez
 Page 16-17 *A Desert Illuminated* photos - Dr. John Schaefer
 Page 20 *Desert Discovery Trail* - Adam Rodriguez
 Page 20 MaryLynn Mack - Adam Rodriguez
 Page 21 Delegates of the Global Botanic Gardens Congress in Dublin, Ireland - BGCI
 Page 21 Exhibit reception, Kolb Studio, July 6, 2010 - Wendy Hodgson
 Back Cover *Luminarias 2010* - Adam Rodriguez
 Photo correction: *Sonoran Quarterly*, September 2010, Volume 64, No.3 page 6. The man in the black and white photo was misidentified as George Lindsay, he was, in fact, a member of Lindsay's plant salvage crew.

in appreciation

The Desert Botanical Garden is grateful to all 20,722 members and donors for their support. Acknowledged in this section are annual Curator's Circle, Director's Circle, President's Circle and Founder's Circle members and donors giving \$2,500 or more over the year, from June 16, 2009 through September 15, 2010. Included are memberships, Desert Towers initiative and unrestricted gifts to support the Garden's annual operations.

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The Desert Botanical Garden Mission

The Garden's commitment to the community is to advance excellence in education, research, exhibition, and conservation of desert plants of the world with emphasis on the Southwestern United States. We will ensure that the Garden is always a compelling attraction that brings to life the many wonders of the desert.

las noches de las luminarias

DESERT BOTANICAL GARDEN

Presented by The Arizona Republic

Make plans for the Valley's best holiday event where the Garden comes to life with more than 8,000 hand-lit luminaria bags and eleven musical groups performing nightly.

Luminaria offers guests a choice of 21 nights in December, including dates between Christmas and New Year's Eve. Visit dbg.org for additional event information.

DATES

Members / December 2, 3, 4, 5

General Public / December 9, 10, 11, 12, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30

TICKET PRICES

Members: Adults \$20, Children \$10

(ages 3-12) *Children under 3 admitted free*

General Public: Adults \$25, Children \$12.50

(ages 3-12) *Children under 3 admitted free*

HOURS

5:30 – 9:30 p.m.

TO PURCHASE TICKETS

- Order online at dbg.org
- Call 480 481.8188 (8 a.m.-8 p.m., Mon.-Fri., 8 a.m.-5 p.m., Sat.-Sun.)
- Visit the Admissions Box Office (8 a.m.-8 p.m. daily)

For 25 or more tickets call 480 481.8104.

Ask about private group dining options. Group discount will apply.


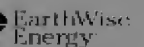
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